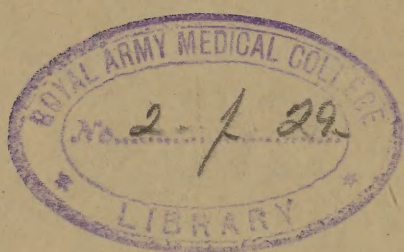


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1909.
DEPARTMENTAL COMMITTEE ON HUMIDITY AND VENTILATION IN
COTTON WEAVING SHEDS.

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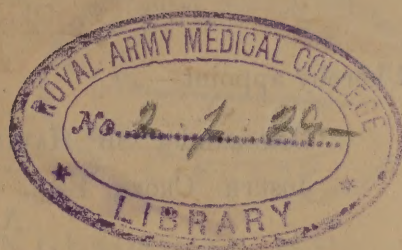
REPORT

OF THE

DEPARTMENTAL COMMITTEE

ON

HUMIDITY AND VENTILATION IN COTTON WEAVING SHEDS.



Presented to both Houses of Parliament by Command of His Majesty.



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1909.

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WARRANT OF APPOINTMENT.

I hereby appoint—

Commander Sir HAMILTON FREER-SMITH, R.N.,

JOSEPH CROSS, Esq., General Secretary, Northern Counties Amalgamated Association of Weavers,

HENRY HIGSON, Esq., Chairman, North and North East Lancashire Cotton Spinners' and Manufacturers' Association,

T. ROBERTS, Esq., Chairman, Darwen Cotton Manufacturers' Association,

D. J. SHACKLETON, Esq., M.P., and

Professor JAMES LORRAIN SMITH, Victoria University, Manchester,

to be a Committee to inquire and report—

(1) What temperature and humidity are necessary in each case for the manufacture of different classes of cotton fabrics ;

(2) At what degrees of heat and humidity combined definite bodily discomfort arises, under the conditions of the work carried on by the operatives and what, if any, danger to health is involved by continuous work at those degrees ;

(3) What means of cooling humid sheds (where necessary) exist, whether combined with the means of humidifying or otherwise, which are both efficient and practicable, having regard to the conditions required for the manufacture of the several classes of goods ;

(4) What special arrangements, if any, are necessary in order to admit of the proper ventilation of dry weaving sheds without prejudice to the process of manufacture.

And I further appoint Sir Hamilton Freer-Smith to be Chairman, and Duncan Randolph Wilson, Esq., one of H.M. Inspectors of Factories, to be the Secretary of the said Committee.

H. J. GLADSTONE.

27th November, 1907.

I hereby appoint—

WILKINSON HARTLEY, Esq., of Carr Hall, Nelson, Lancashire, and

FRED THOMAS, Esq. (Secretary, Burnley Weavers' Association), Weavers' Institute, Charlotte Street, Burnley,

to be additional members of the Committee of Inquiry into the question of Humidity and Ventilation in Cotton Weaving Factories, for the purpose in especial of that part of the Inquiry which relates to the Factories into which artificial humidity is not introduced.

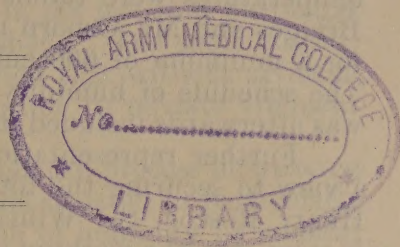
H. J. GLADSTONE.

Whitehall,

17th March, 1908.

DEPARTMENTAL COMMITTEE ON HUMIDITY AND VENTILATION IN COTTON WEAVING SHEDS.

REPORT.



TO THE RIGHT HONOURABLE HERBERT JOHN GLADSTONE, M.P.,
HIS MAJESTY'S PRINCIPAL SECRETARY OF STATE FOR THE HOME DEPARTMENT.

Manchester,
7th January, 1909.

SIR,

We have the honour to report as follows:—

The Committee met for the first time at Manchester on the 13th December, 1907; since then 44 meetings have been held, 37 in Manchester and the neighbourhood, 4 in Glasgow, and 3 in Bradford. 76 "humid," 31 "dry" sheds, 4 worsted mills and 10 works where ventilating plant is manufactured or used, have been visited, and 96 witnesses have been examined, including the recognised authorities on the physiological aspect of the questions referred to the Committee, experts on industrial technicalities, 7 of H.M. Inspectors of Factories, 8 medical experts (certifying surgeons, medical officers of health, and general practitioners), 12 manufacturers, 9 managers, 6 trade union officials, and 47 operative weavers. The full list of witnesses, with reference to their evidence, appears with the Minutes of Evidence.

It will be within your remembrance that the difficult questions at issue have been under consideration for a period of about 36 years. In 1872 Dr. Buchanan reported on certain sizing processes used in cotton manufacture at Todmorden. Presumably, that is about the period when the practice of infusing artificial humidity became common, although steaming had been introduced into Padiham from America many years previously.

Owing to a representation by the Parliamentary Committee of the Trades Union Congress in 1882, relating to oversizing and the infusion of steam into weaving sheds, a report was drawn up by Dr. Bridges, and Mr. Osborn, one of H.M. Inspectors of Factories, the chief complaint at that time being that "the clothes of the workers were so damped by the warm moisture given off by the steam, that, after going out into the open air, coughs, colds, and the whole train of lung diseases were contracted, and rheumatism and many other bodily afflictions . . . followed."

The main conclusions arrived at by Dr. Bridges and Mr. Osborn were that there were strong reasons for believing that neither excessive dust nor steam were inseparable from the process of heavy sizing, processes being known to certain manufacturers in the district and supposed to be trade secrets, by which very large quantities of size could be incorporated with the warp without necessitating the diffusion either of dust or of moisture, and that there existed an evil greater than dust or steam, namely, the lack of efficient ventilation in the sheds.

The trade secrets referred to appear still to remain secrets, since in no instance has it been found by the Committee that heavily-sized goods were manufactured without the aid of artificial humidity, except in one or two sheds that are naturally exceptionally damp from their situation. It is, however, a striking fact, that, speaking generally, the relative humidity in sheds where light and medium sized goods are made is higher than in the heavy sizing sheds. (Appendix XIII.)

In 1887, Dr. Stephenson, Medical Officer of Health for Blackburn, published an alarming report on the health of the cotton workers in that district, in consequence of this the borough Health Committee in 1888 instituted a special inquiry, and came to the conclusion that the ventilation of the mills was unsatisfactory, especially in winter, that heavy steaming had been practised in Blackburn, and the conditions under which work was carried on had influenced the high death rate of the borough; and that heavy and excessive "steaming" was injurious to the health of those that

work in the sheds, but that light steaming accompanied by proper ventilation was not injurious.

The Cotton Cloth Factories Act, a private Act, was passed in 1889, and for the first time maximum limits of the humidity permissible in the atmosphere for different temperatures were tabulated, and effect was given to the recommendation of Dr. Bridges and Mr. Osborn in regard to efficient ventilation, a stipulation being made for a minimum of 600 cubic feet of fresh air per hour for every person employed. The schedule of humidity was drawn up with the advice of Sir Henry Roscoe and was afterwards included in the Factory and Workshop Act, 1901.

Further representations having been made by the Weavers' Associations with a view to securing the total abolition of "steaming," a Committee consisting of Sir Henry Roscoe, Sir William Roberts and Dr. Arthur Ransome was appointed to inquire into the working of the Act of 1889. The report, made in 1897, contained certain recommendations, most of which were embodied in 1898 in a statutory order of the Secretary of State, under powers conferred on him by the Cotton Cloth Factories Act of 1897. This order did not vary the amount of moisture allowed but contained provisions relating to ventilation, temperature and hygiene, the most important being requirements for an additional record of temperature between 7 and 8 in the morning, covering of steam pipes, whitewashing of roofs, provision of cloak rooms, purity of water to be introduced in the form of steam, and the substitution of a standard of ventilation of nine volumes of carbonic acid in 10,000 for the older standard then in force.

On the passing of the Factory and Workshop Act of 1901, the Cotton Cloth Factory Act, as modified by the above Order, was embodied in the Consolidating Act without further change.

Owing to assertions on the part of manufacturers that while it was practicable to conform generally to the nine volume standard of ventilation, it was not practicable to maintain it at all times in all parts of every shed, as the terms of the statute required, it was agreed between the Home Office and representatives of the manufacturers that samples should be taken and determinations made by Mr. Frank Scudder, F.I.C., in 30 weaving sheds selected by the Home Office. His report, presented in 1904, proved that with adequate and efficient ventilating plant it is possible to keep the air of a shed within the prescribed limit, notwithstanding inequalities due to local or accidental circumstances.

Weavers' ballot.

The references made to legislative action on behalf of the weavers indicate that serious efforts have been made to secure for them all that appeared necessary for health and comfort, but as will be shown, this, in the opinion of the operatives themselves, has not yet been attained. So strong was the feeling amongst the workers that "steaming" produced not only great bodily discomfort, but also injury to health, that in November, 1906, a ballot was organised by the operative leaders at the request of the operatives, the result being:—

For the abolition of "steaming"	-	-	-	-	-	68,154
Against	„	„	-	-	-	3,094
Neutral	-	-	-	-	-	1,221

Total voting - - - 72,469

The details relating to this ballot and the methods adopted will be found in Appendix XXI.

The result is certainly convincing, and is supported, at all events as regards bodily discomfort, by the evidence taken by the Committee.

So far as injury to health is concerned, the evidence does not prove direct injury to health, but inferences may be drawn and opinions formed as to whether from long continued work under conditions causing bodily discomfort, injury to health would follow.

It must be borne in mind that on all sides it is admitted that weaving conditions, especially when inferior yarn is used, are improved by the use of artificial humidity. The weavers are piece-workers and the total abolition of "steaming" would certainly in many places increase their labour and reduce their wages. This argument, apart from any other considerations, is indicative of the sincerity of the wish of the workers to dispense with artificial humidity.

But while it is recognised by the Committee that the demand for inquiry was fully justified, other considerations of weight have suggested methods less stringent than the total abolition of artificial humidity, and it is believed that the recommendations of the Committee will meet the case.

In the United Kingdom there are about 1,030 humid and 1,636 "dry" cotton weaving sheds; seeing that weaving without artificial humidity is successfully carried on in about 61 per cent. of the factories and under conditions that generally speaking cannot be condemned, it seems reasonable not only for the workers but for others interested in the question to ask why artificial humidity should be introduced into any shed, and the answer, it would appear, lies in the fact that particular classes of goods of better quality are made in the "dry" sheds. The same classes, however, are manufactured in humid sheds, but it is asserted that without artificial humidity the superior kinds of yarn must be used, in order to obviate frequent breakages and delays caused by constant "piecing."

Practically all recognised authorities are of opinion that the process of weaving is facilitated by the use of artificial moisture, except in sheds situated in particularly damp places or on damp soils, and prior to the introduction of humidity by modern systems, primitive methods, such as damping the floor, known as "degging," placing of troughs containing water under the looms or wet clothes on the beams, were in common use, especially when dry winds prevailed.

Throughout the civilised world the practice of humidifying is found, and it is believed that in no country other than the United Kingdom is there any direct legislation limiting the amount of moisture. The manufacture of the class of cotton cloth in the weaving of which humidity is specially necessary forms a substantial part of the Lancashire trade. Many witnesses suggested that by the use of better material or improved sizing, the necessity for humidity would cease, but so long as there is a demand for low-priced material made with comparatively inferior yarn, so long will the supply be forthcoming from some source, and if not from this country, from others, to the detriment of British trade.

The limitations as to humidity recommended by the Sir H. Roscoe's Committee and the other suggestions made by them and accepted by the Secretary of State, have without doubt added much to the comfort of the workers. At the time that this Committee reported it would seem that the chief evil complained of by the operatives related to the deposit of moisture in the clothing. An attempt was made by your Committee to ascertain exactly what was running in the minds of the members when the schedule was drawn up, and on this point the evidence of the following witnesses has been very valuable:—Mr. Frank Scudder, F.I.C., who at that time was officiating as assistant to Sir H. Roscoe, Mr. W. Williams, H.M. Inspector of Factories, Secretary of the Committee, and Dr. Arthur Ransome, F.R.S., one of the Members.

The tables and diagrams handed in by Mr. Scudder (Appendix I.) and his evidence before the Committee seem to indicate that the chief evil in view was the deposit of moisture and the consequent chilling effect, rather than the physiological disturbance caused by work in a hot and humid atmosphere; the evidence given by Dr. Ransome tends to confirm this opinion, and it was freely admitted by him that the present table of humidity might with advantage be amended.

In addition to the observations made by the Committee when visiting works, statistics relating to humidity and ventilation in humid and dry sheds have been prepared from the best available sources.

In humid sheds, where a standard of ventilation is in force, it may safely be assumed that the condition of the air, speaking generally, approximates to that standard.

Appendix X. contains a summary of the results of analysis of all air samples taken in humid weaving sheds between 1st January, 1906, and 30th April, 1907. It appears that in some 38 per cent. of the total number the carbonic acid was found to be in excess of the legal standard, but it must be remembered that although this proportion may seem to be unduly high, in many instances the excesses would naturally be due to temporary and unavoidable causes.

As regards non-humid sheds, more careful inquiry was called for, it being asserted that, in winter especially when natural ventilators have been closed, the air as measured by the carbonic acid test is exceedingly impure, and furthermore that the humidity in these sheds, caused by the moisture given off in the breath and from the bodies of the occupants, approximates to and in some instances is equal to that in the humid sheds.

On referring to the First Report of the Departmental Committee on Ventilation in Factories (1902), we find that no fewer than 62 air tests were made in non-humid sheds, the majority of these in the months of January and April, and a few in May. The results, speaking generally, were very satisfactory, although in exceptional cases the carbonic acid present was much in excess of what is generally considered desirable for health.

Appendix XI. gives a summary of the results of analysis of air samples taken by H.M. Inspectors of Factories between 1st January, 1906, and 30th April, 1907, amounting in all to 1,246 tests, of which 391 were taken between 1st January and 30th April, 1906, 300 between May and 31st August, 1906, 254 between the 1st September and 31st December, 1906, and 301 between the 1st January and 30th April, 1907; these tests were taken in all parts of the country, and in a few factories the work done, though technically cotton weaving, is different in many respects from that under the consideration of the Committee. Taking into consideration North and South Lancashire, Cheshire, Yorkshire, and Scotland, the results in non-humidified cotton cloth factories may be summarised as follows:—

Period.	Sheds.	Samples taken.								Total.
		(CO ₂ in volumes per 10,000).								
		6	9	12	15	20	25	30	Over 30	
September to April - -	1,390	55	183	182	93	97	53	23	26	712
May to August- - -		103	118	45	16	11	—	—	—	293
Total- - - -		158	301	227	109	108	53	23	26	1,005
Per cent. :—										
September to April - -		7.7	25.8	25.6	13.1	13.6	7.4	3.2	3.6	100
May to August - - -		35.1	40.3	15.4	5.5	3.7	—	—	—	100
Total - - - -		15.7	30.0	22.6	10.8	10.7	5.3	2.3	2.6	100

showing that although the ventilation, speaking generally, is satisfactory, in many mills improved conditions are called for.

The Manufacturers' Association, desiring that tests should be taken on their own behalf, entrusted this work to Dr. Robert H. Pickard, of Blackburn; the results of his investigations are given in Appendix XII. The conclusion to be drawn from an inspection of these figures confirms the opinion already expressed that, whereas in a large proportion of sheds the condition of the air cannot be seriously objected to, yet in others improved ventilation is called for. The tests taken from time to time by H.M. Inspectors of Factories in the sheds under consideration seem to agree very closely with those taken by Dr. Pickard.

In order to form opinions as to the relative humidity required for successful weaving in places where different classes of goods are manufactured, in addition to the evidence taken by the Committee and the observations made during their visits, statistics were prepared giving the mean monthly temperatures and humidities of certain humid sheds for 1906, compared with the outside temperatures and humidities for the same hours. (Appendix XIII.)

From the Home Office records, 31 typical sheds were selected; of these, 11 use light sizing (5 to 25 per cent.), 10 medium sizing (25 to 70 per cent.), and 10 heavy sizing (70 to 200 per cent.). Both the centre and side readings are included, and the statistics cover every month during 1906. The following deductions may be drawn from the tables:—

(1) The relative humidity in sheds where heavily and medium-sized goods are manufactured is slightly less than where lightly-sized are made.

The following are the mean values for the year:—

	6—7 a.m.			10—11 a.m.			3—4 p.m.		
	Light.	Medium.	Heavy.	Light.	Medium.	Heavy.	Light.	Medium.	Heavy.
Centre - - -	79	75	76	76	72	73	74	70	71
Side - - -	80	76	76	78	73	75	75	72	73

(2) The side readings indicate, as a rule, a lower temperature and a greater relative humidity, as would be expected from the shorter distance of the hygrometer from the walls and consequent effect of outside influences. Several exceptions to this, however, are found in the case of individual sheds, caused probably by artificial

heat being conveyed through the walls from an adjoining boiler-house or other hot rooms.

(3) In the course of the day the absolute humidity and temperature increase almost invariably, while the relative humidity diminishes, indicating that the amount of moisture in the atmosphere is continually accumulating, while the temperature rises proportionately faster, so that the relative humidity decreases.

(4) The assertion, so often made, that the relative humidity inside the shed is less than that outside is true of the winter months only; during the summer the inside relative humidity is the greater, except in the early morning.

It would have been more satisfactory had a larger number of figures relating to humidity in non-humid sheds been available, but it is thought that the statistics in Appendix XIV., giving the mean monthly temperatures and humidities of six non-humid sheds for 1906, compared with the outside temperature and humidity at the same hours, will be sufficient for practical purposes, covering, as they do, every month during the year. The figures have been obtained from continuous records taken by a few manufacturers in non-humid sheds. Further information on this point would necessitate considerable delay in the presentation of this Report, but arrangements have been made for records to be kept in certain sheds during the present winter. Thirty tests were also made by the Committee on visiting works.

From the figures quoted it appears that the relative humidity in dry sheds is considerably lower than that generally found in humid sheds, the highest average being 68 per cent. for October for the readings taken between 7 and 8 a.m.

In regard to the first term of reference, little information has been obtainable. The statistics in Appendix XIII. indicate that the relative humidity for heavily-sized goods is practically the same as for medium and light-sized goods. The only class of cotton fabric in the weaving of which artificial humidity is almost universally dispensed with, is "coloured" goods, but even in this case, according to the evidence of Mr. John Tay'or, joint secretary of the North and North-East Lancashire Manufacturers' Association, the weaving would be improved by artificial moisture which is only withheld on account of the risk of the colours "bleeding" into the gray ground. In regard to temperature, the diagram in Appendix XV. shows that there is, practically speaking, no difference in the wet-bulb temperatures found in the sheds where material with different quantities of sizing are manufactured.

After nearly twenty years' experience of work under the present legal conditions in cotton cloth factories, it is shown by the ballot of weavers, and corroborated by personal observation by the members of the Committee and by the evidence taken by the Committee, that, apart from conditions directly affecting health, what is now chiefly complained of is the discomfort caused by working in moist atmospheres at high temperatures.

The alleged chilling effect noticeable when leaving the hot atmosphere of the sheds is still the subject of complaint, but it is believed that this is due to perspiration and absence of evaporation causing dampness in the clothing worn, rather than to deposit of moisture in the clothing taken off, except when such clothing is kept in unsuitable places.

By the workers it is asserted that in addition to actual bodily discomfort, lassitude, want of energy and enervation result, it is commonly thought also that there is injury to health, but, as has been stated before, the direct evidence on this point taken by the Committee does not justify any decided expression of opinion; inferences, however, may reasonably be drawn.

A perusal of the evidence will show that special attention has been given to what may in a measure be considered a new factor. The table of humidity contained in the Fourth Schedule of the Act of 1901, originally drawn up, it is understood, under the advice of Sir Henry Roscoe, begins at a dry bulb temperature of 35° F., and wet bulb temperature at 33° F., and ends with a dry bulb temperature of 100° F., and wet bulb temperature of 91° F. It cannot, however, have been thought possible to carry on the process of weaving at a temperature of 35°, nor can it have been supposed that the operatives could endure a wet bulb temperature of 91°.

Attention of physiologists has recently more than ever been given to questions relating to the effects on the human system of working at a high wet bulb temperature, and experiments have been made yielding highly important results; at the same time observations have been made on the conditions under which heat stroke occurs, particularly amongst soldiers marching in hot weather. (Haldane, Rubner, Pembrey.)

The Committee was fortunate in being able to secure the evidence of several of the chief investigators of this question.

A paper on the influence of high air temperatures was published by Dr. J. S. Haldane, in the "Journal of Hygiene," v., 4. (October, 1905). The details relating to his experiments are very fully set forth and may be summarised by the following quotation:—

"The bearing of these experiments on the question as to the rise in temperature allowable on economic or humanitarian grounds in places where persons have to work continuously will be sufficiently evident. It is clear that in still and warm air what matters to the persons present is neither the temperature of the air, not its relative saturation, nor the absolute percentage of aqueous vapour present, but the temperature shown by the wet bulb thermometer. If this exceeds a certain point (about 78° F. or 25·5° C.) continuous hard work becomes impracticable; and beyond about 88° F. or 31° C., it becomes impracticable for ordinary persons even to stay for long periods in such air, although practice may increase to some extent the limit which can be tolerated. In moving air, on the other hand, the limit was extended upwards by several degrees. The men working a rock drill in a 'hot end' or 'rise' in a mine, for instance, have the great advantage that the air is kept in constant motion by the exhaust from the drill; and that as this exhaust air is very dry the wet bulb temperature at the working place is considerably reduced, even if the rock be wet or damped by a jet or spray of water to prevent dust."

The statement here quoted was corroborated by Dr. Haldane when giving evidence before the Committee on the 27th February, 1908. Dr. Haldane, while admitting that the relative humidity was an important element when considering the deposition of moisture from the air and the possible chilling effect on leaving the sheds, was emphatic in pointing out that relative humidity is not what determines the effect on the human system. He states:—

"I should propose that 75° wet bulb be taken as a maximum; that is to say, that the schedule should stop at 75° wet bulb. Below that there should be always a difference of two degrees between the two thermometers. Make a simple rule of that kind, which is practically the present schedule, and that during the cooler part of the year the maximum wet bulb should be 70°. My reason for that is that in the cooler part of the year people wear more clothing, and that consequently when they get into a warm place, they are more liable to feel the heat and get wet from perspiration. 70° wet bulb is the temperature which the Home Office Factory Ventilation Committee specified as the maximum which should usually be allowed in a factory; but I think, considering the special conditions in Lancashire weaving sheds, and limiting the 75° to the summer weather, the warmer part of the year, there should be no objection to going to 75°."

He was in favour of humidifying by means of water, which serves the double purpose of supplying the requisite moisture and of producing cooling by rapid evaporation, a system adopted with different degrees of success in some of the methods of humidifying.

Dr. Leonard Hill, in his epitome of evidence (Appendix VI.), agrees with all Dr. Haldane's evidence before the Committee in regard to demonstrating that the wet bulb temperature alone determines with accuracy the physiological effect on the human system, and also in his criticism of the existing table of humidity, describing the possibility of working at a wet bulb temperature of 80° to 90° as absurd.

He stated also in his evidence before the Committee:—

"I should agree with the limit which Dr. Haldane has fixed, about 60° to 75°. That exactly agrees also with some determinations of Rubner, who was one of the most eminent authorities in Germany on the subject."

Dr. Pembrey refers to the results of his observations on himself, soldiers and medical students. These show definitely that a man is much less efficient in a warm moist atmosphere. He further states in his epitome of evidence (Appendix IV.):—

"It is in my opinion to the advantage of both employer and employed that the work in weaving factories should be performed at temperatures below 70° F. by the wet bulb; at the lower temperatures work could be done at a faster rate, more efficiently and with less fatigue, discomfort and injury to health. The effect of work in a warm, moist atmosphere is to increase the temperature, pulse, and loss of moisture out of proportion to the work done."

"Efficient work cannot be performed unless the temperature of the body is prevented from rising above a certain optimum."

Dr. A. E. Boycott in his epitome (Appendix V.), says:—

"I am of opinion that operatives should not be called upon to work with the wet bulb above 75° F., and that it would be desirable, though perhaps not always practicable that the upper limit for active work should be 70° F."

Professor John Cadman states (Appendix VIII.):—

"For a number of years I have been studying the effect of temperature upon workmen employed in mines, and in the tropics. I have come to the conclusion that the individual susceptibility to temperature depends entirely on the temperature recorded by the wet bulb thermometer, no matter what the dry bulb registers."

Question 3139.

Question 3856.

Finally attention should be called to the following quotation from Nagel's Physiology:—

“When the air is very humid, the heat loss by evaporation is very much lessened, and accordingly at 80% humidity a temperature of 24° C (75·2° F.) becomes after a time insupportable to a man unaccustomed to it, and exposure to it is only possible with complete muscular rest. If, however, the air is very dry, a temperature of 24° to 29° C. (75·2° to 84·2° F.) can be easily endured.” (Rubner and Lewaschew, quoted by Tigerstedt in Nagel's Physiology, I. II. 1, p. 586.)

Amongst the medical witnesses examined, including several in local practice and others who have had previous experience of the districts concerned, the general opinion appears to be that since the introduction of the C.C.F. Act of 1889, the health of the workers has improved, this being due to better ventilation and less dust, and statistics relating to the weavers in Blackburn have been published by Dr. Alfred Greenwood, Medical Officer of Health for the borough, which support this view.

It must, however, be remembered that the statistics on which these opinions are based include sheds of all kinds, in many of which excessive temperature and a high degree of humidity are not found, and it is not denied that moisture in excess and at high temperature produces discomfort and possibly eventual injury to health. In the course of the medical evidence also it was asserted that a dry shed even with comparatively bad ventilation is preferable to a humid shed conforming to the present nine volume standard.

When considering “at what degrees of heat and humidity combined bodily discomfort arises . . . and what, if any, danger to health is involved by continuous work at those degrees,” the question of ventilation is necessarily one of no small importance and has been very carefully considered.

The ventilation standard affects very materially questions relating to humidity. Under meteorological conditions producing comparatively dry air, the oftener the air in the shed is changed the more necessary it becomes to introduce artificial humidity in aid of the weaving process.

It will be remembered that the Haldane Committee, reporting in 1902, recommended a standard of 12 volumes of carbon dioxide per 10,000, or 20 volumes, when gas or oil is used for lighting. These proposals came in for serious criticism and were by some considered as reactionary. In these circumstances it was felt that the question should be approached with great care.

Recognised authorities, such as Parkes, de Chaumont and Pettenkofer, recommended a standard varying from 6 to 10 volumes per 10,000. It is generally accepted that the carbon dioxide is an indication of other impurities present, and that injury to health will result from these impurities rather than from the carbon dioxide itself. The authorities quoted doubtless aimed at securing under all conditions a breathing atmosphere approaching as nearly as possible the normal condition of the outside air.

Attempts have been made by the Committee to obtain information as to whether by actual experiment, reliable statistics or other data, it has been shown that injury to health would follow when persons were regularly employed in rooms, the atmosphere of which contained carbon dioxide somewhat in moderate excess of the limits quoted.

High authorities, such as Dr. Ransome, have called attention to the improved health of soldiers in barracks, prisoners in gaols, etc., resulting from better ventilation, but it must be remembered that both in barracks and in gaols the general state of things formerly existing left much room for improvement, and further that the many good influences brought to bear upon soldiers of to-day have completely altered their habits and method of life, whilst in prisons better dietary and other conditions may well account for the undoubted improvement. Reference was also made by Dr. Ransome to vital statistics published by the Registrar General and health officers throughout the country, but it is well known how difficult it is to classify different occupations in such a way as to decide such a delicate question as to whether the altered conditions involved in the addition of a few parts per 10,000 of carbon dioxide could cause injury to workers in any particular trade.

The evidence will show that in British coal mines the average carbon dioxide present is about 35 volumes per 10,000, notwithstanding the frequent changing of the air, and in the new Mines Regulation Act for the Colony of Victoria, the standard is fixed at 25 volumes. These high standards, it has been suggested, are justified by the fact that the carbon dioxide found in mines is derived from chemical oxidation, whereas that found in weaving sheds is in a much larger degree due to respiration. It may be

open to question whether the source from which the carbon dioxide is derived justifies the wide difference between the limits allowed in weaving sheds and in mines.

Some answers to the questions raised on this point may be given from the evidence taken by the Committee:—

Dr. J. S. Haldane says (Appendix III.):—

“As a member of the late Home Office Committee on Factory Ventilation, I concurred in recommending that a maximum of 12 volumes of CO_2 per 10,000 should be taken as the legal maximum in all factories; and, considering that the textile industry is not unhealthy, except in dusty processes, and that there is no approach to over-crowding, we did not recommend any stricter standard for this industry. This standard permits of the addition of a very appreciable amount of moisture to the air by natural and unavoidable means, and were it adopted, no artificial moisture might be needed for weaving. I think, however, that light steaming with pure steam, or light humidification by evaporation of water, to the extent of, say, 65 per cent. humidity, might also be permitted, provided a wet bulb temperature of 70° were not exceeded by such means, and that a wet bulb temperature of 75° were avoided at all times.”

Dr. Leonard Hill states (Appendix VI.):—

“The ill effects of crowded rooms are due to the heat and humidity, and nervous fatigue from excessive illumination and excitement, not to the increase of carbonic acid. I think it is very doubtful if the unpleasant smelling exhalations of the bodies of men, which become evident in close atmospheres, have any ill effect on men accustomed to them and not of æsthetic temperament; the bulk of the population prefer warm shut-up rooms. The stimulating and healthful effect of fresh moving air on metabolism is undoubted, but in weaving sheds we are faced with the necessity of enduring a shut-up humid atmosphere, and it seems best to obtain it by the method which is most comfortable to the operatives. If they prefer a lessened ventilation and no artificial steaming of the air I would let them have it, so long as the wet bulb temperature was kept within the limits defined by Dr. Haldane.”

Dr. M. S. Pembrey says (Appendix XIV.):—

“As regards the question of the standard for the amount of carbon dioxide in the air of the humid weaving sheds, I see no objection to raising it to 12 volumes per 10,000, provided that the temperature of the air by the wet bulb is lowered below 70° F.

“One cannot detect any bad effect from 60 volumes per 10,000 when the temperature of the room is low. Too much stress has been laid upon the question of carbon dioxide; its presence has been used as a test for defective ventilation, and in this way the mistake has arisen of considering it the injurious factor. All recent investigations in this country, on the Continent and in America show that temperature, moisture and wind are the most important factors in connection with the injurious effects of badly ventilated rooms. The important thing is to keep the wet bulb temperature low, and to prevent the air from becoming stagnant and uniform in temperature.”

Dr. A. E. Boycott states (Appendix XV.):—

“The question of raising the permissible limit of CO_2 from 0.09 to 0.12 per cent. seems to me to depend almost entirely on considerations of what is practicable. It is desirable that the air in the weaving sheds should approximate as closely as possible to the composition of pure outside air in its contents of CO_2 , not because 0.1 per cent. or even 1 per cent. of CO_2 is in any way hurtful, but because CO_2 gives the best available index of the extent to which air is vitiated by the products of manufacturing processes, the combustion of gas, or by the micro-organisms and unpleasant smells arising from human beings. The free ventilation required to keep down the CO_2 is of value not only by preventing the accumulation of these bodies, but also by producing currents of air of varying temperatures. Apart from smell, the essential difference between a ‘fresh’ and a ‘stuffy’ room is that in the former the air is not all at the same temperature, but is broken up by draughts which impinge on the hands and face, lower the skin temperature, and so produce a feeling of liveliness. The qualities of freshness and stuffiness in a building, and in consequence the energy or slackness of the inhabitants, has nothing to do with the content of the air in CO_2 as such. Cool air, free from unpleasant smell but containing 3 per cent. of CO_2 , I have found to be a distinctly invigorating mixture.”

In the consideration of this question, the feelings of the persons most concerned, namely, the workers, should carry weight, although this evidence has by certain scientists been considered as of little value.

The statistics in Appendix X. show that in humid sheds from 1st January, 1906, to 30th April, 1907, the carbon dioxide was found to be in excess of the legal standard of 9 volumes per 10,000 in about 38 per cent. of the samples taken. In “dry” sheds, where there is no legal standard, the excess over 9 volumes in 10,000 was observed in approximately 50 per cent. By the operatives in dry sheds not a single complaint has been made, whereas in the humid sheds with a legal standard complaints seem to be universal.

For instance, the Committee visited the Cardwell Mill, in Blackburn; in this mill the same class of goods is manufactured in two sheds under the same roof, with a partition between them; in one, artificial humidity is introduced, the other is a dry shed. The managing director placed before the Committee health statistics covering a period of eight months, showing clearly that, although the carbonic acid in the dry shed varied between 34 and 41 volumes in 10,000, yet nevertheless the workers in the dry shed were as healthy as those in the humid shed, and the latter vied with one another to get employment in the dry shed. (Appendix VII.)

It is pointed out by Dr. Ransome that condensed aqueous vapour derived from respiration is an excellent medium for the cultivation of micro-organisms, both putrefactive and pathogenic, and for this reason the present standard of ventilation should be maintained; but Dr. Leonard Hill, whilst approving a twelve standard, says (Appendix VI.) :—

“As to the question of infection in such less well ventilated atmospheres, I would point out that the experiments of Buchner, Flügge and others have shown that tubercle bacilli and other organisms are sprayed through a room from the mouth, when men talk or cough, for a distance of many feet and over wide areas, and that susceptible animals, such as guinea-pigs, are infected when extraordinarily small doses of tubercle bacilli are sprayed into the room in which they are placed. In the case of influenza, the conditions of civilized life in railway and tram cars, meeting houses and living rooms, render all infected who are not immune.

“Modern investigation points to the enormous importance of an immune stock, and to the effect of cheap good food and comfortable conditions of life in preventing tuberculosis. We are all constantly exposed to infection, but our resistance prevents it. I do not think, therefore, that the lessened ventilation will have any effect in increasing disease, so long as it does not increase the amount of trade dust in the air.”

A reference to trade dust recalls the fact that in many of the mills visited, especially where heavy-sized goods are made, sufficient care had not been taken for the removal of dust, and that in others the floors were not kept in the cleanly state contemplated by the Act of Parliament.

On the other hand, direct experiments have been carried out by Haldane and Lorrain-Smith to discover if possible any evidence as to the toxic effect of volatile organic matter in expired air, other than carbon dioxide, with entirely negative conclusions. These investigators injected into animals the condensed vapour from expired air, but the results were entirely negative. They also made observations on the breathing of air heavily charged with CO₂ derived from respiration, and therefore at the same time containing a large amount of the supposed volatile organic matter, but were unable to detect any effect other than that due to carbonic acid, moisture and heat. (Haldane and Lorain-Smith, “The Physiological Effects of Air Vitiated by Respiration,” “Journal of Pathology and Bacteriology,” October, 1892, and “The Toxic Action of Expired Air,” the same journal, February, 1893.)

The conclusion arrived at in the former research was that—

“the immediate dangers from breathing air highly vitiated from respiration arise entirely from the excess of carbonic acid and deficiency of oxygen, and not from any special poison,” and in the latter paper it is stated that “these experiments, like our former ones on rabbits and man, are distinctly against the theory that a volatile poison, other than carbonic acid exists in expired air.”

It is admitted, however, that the results obtained differ from those of Merkel, and Brown-Sequard, and d’Arsonval, in regard to their experiments on the effects of expired air on mice, but explanations are given accounting for this.

The following extracts from the writings of physiologists abroad are strongly confirmatory of the opinions already quoted :—

“The hygienic value of ventilation for the purpose of maintaining a pure atmosphere in dwellings, schools and hospitals is not so great as is commonly supposed. It is far more important to ventilate in the interest of the heat economy of the body by the establishment of a suitable temperature and air movement and by the regulation of the humidity in the atmosphere.

“Unprejudiced medical observations point to the non-existence of a poison in breath. Millions of persons of the lower and middle classes enjoy unimpaired health for years, although they daily breathe in this ‘human poison.’ It is true that of these a certain percentage suffers from disease, but not from diseases other than those obtaining among the higher classes who have the advantage of the best ventilated dwelling and sleeping rooms.” (Krieger, ‘Der Werth der Ventilation,’ Strasburg, 1899.)

“1. In the lungs of a healthy person besides the known substances carbon dioxide and water no poisonous substance exists, that mixes with the expired air and leaves the lungs with it.

“2. In the experiments that show the poisonous properties of expired air and in which its toxic character is attributed to the action of an unknown organic base, the effects were due to ammonia which caused the appearance of poisoning, and this was wrongly ascribed to an unknown substance of basic character.” (Fornánek, Arch. Hyg. 38 (1900), p. 1.)

“Books on hygiene and ventilation still teach, almost without exception, that ventilation of dwelling rooms is necessary because the atmosphere is impaired by the gaseous excretions of human beings, and that we may regard the CO₂ contents of the air as a measure of this deterioration.”

“1. Numerous researches with accurate experimental methods and with exact regard to thermal conditions, on both healthy and diseased subjects have shown that the chemical variations of the composition of the atmosphere which occur in inhabited rooms through the gaseous excretions of men, do not exercise an injurious effect on the health of the inhabitants.

“2. Whenever in shut-up, crowded rooms certain impairment of health ensues, involving headache, dizziness, sickness, etc., these symptoms are attributable solely to heat-retention.

“3. The thermal conditions of the surrounding atmosphere, viz., Temperature, Humidity, and Movement, are of enormously greater importance for our comfort and health than the chemical

"composition of the air. Further, the refreshing sensation, noticeable on abundant ventilation of closed rooms or in the open air, results not from the greater chemical purity of the air, but from the more rapid heat-loss from the body.

"4. Over-heating of our dwelling rooms must therefore from a practical point of view be avoided. While this is often difficult of accomplishment in the height of summer, it can be easily carried out during the rest of the year.

"5. It is of first importance that the arrangements for heating should be so regulated that the temperature never exceeds the limit of 21° C. (70° F.). Especially should this control be exercised in public rooms, such as schools, etc.; as a rule the temperature of heated rooms should be 17° to 19° C. (62·6 to 66·2 F.).

"6. In over-heated rooms a certain relief can be brought about by artificial circulation of the air without the introduction of air from outside.

"7. To bring about relief in heated rooms by ventilation is dangerous and should be avoided in winter during the use of the rooms by persons, since chill readily ensues from the influence of the cold air current on the over-heated skin.

"8. On the other hand the over-heating can easily be avoided by periodical ventilation of the rooms during untenanted hours.

"9. From the unpleasant smells present in dwelling-rooms, which result chiefly from the decomposition of matter on the skin and mucous membrane, and also on the clothes of the persons present, no injurious effect on health has been demonstrated.

"10. Nevertheless, these smells cause a feeling of nausea on entering the rooms, and from a practical point of view should be obviated.

"11. This can be brought about partly by prevention and deodorisation and partly by continuous exhaust ventilation, or by periodical through ventilation of the rooms while untenanted.

"12. Ventilation takes no part in freeing inhabited rooms from dust or contagion."

"I would repeat that without doubt symptoms of ill-health are observable in over-crowded rooms, and that an evil-smelling atmosphere is certainly to be objected to for those who are sensitive to it, and that very great importance must be ascribed to the enjoyment of fresh air; but I would also make clear the object of these requirements. It is not the chemical composition of the air but the over-heating of rooms that has the chief evil influence on health, and it is the latter that must be combated; the objection to an evil-smelling atmosphere is to be supported, not on account of its poisonous properties, which have never been proved to exist, but on account of the resulting feeling of nausea; and fresh air is desirable for men, not because they then breathe chemically purer air, but because the continual movement of the fresh air facilitates the loss of heat from their bodies, and exercises besides a very beneficial stimulus on their skin." (Flügge, *Zeit. f. Hygiene und Infektionskrankheiten*, 49, 1905, p. 363.)

"After these experiments there can be no further doubt that the disagreeable symptoms which occasionally appear in assembly rooms, churches, schools, etc., are caused independently of the inspiration of the existing air, and accordingly that the chemical impurity of the air can only play a very subordinate part.

"On the other hand, the experiments have taught that much greater significance must be attached to the physical properties of the air in such localities. Without doubt it is principally the conditions of temperature, humidity and air movement in such places that prevent adequate heat-loss on the part of the human body, and so lead to the well-known unpleasant results, best known under the collective name of "heat-retention" symptoms." (Paul, *Zeit. f. Hygiene und Infektionskrankheiten*, 49, 1905, p. 405.)

"The experiments in which animals were compelled to breathe air vitiated by the products of either their own respiration or by those of other animals . . . make it improbable that there is any peculiar volatile poisonous matter in the air expired by healthy men and animals, other than carbonic acid . . .

"The discomfort produced by crowded, ill-ventilated rooms in persons not accustomed to them is not due to the excess of carbonic acid, nor to bacteria, nor, in most cases, to dusts of any kind. The two great causes of such discomfort, though not the only ones, are excessive temperature and unpleasant odours. Such rooms as those referred to are generally over-heated . . .

"The results of this investigation indicate that some of the theories upon which modern systems of ventilation are based are either without foundation or doubtful, and that the problem of securing comfort and health in inhabited rooms depends on the consideration of the best methods of preventing or dispersing dusts of various kinds, of properly regulating the temperature and moisture, and of preventing the entrance of poisonous gases like carbonic oxide derived from heating and lighting apparatus, rather than upon simple dilution of the air to a certain standard of carbonic acid present." (Billings, Mitchell and Bergey, *Smithsonian Contributions to Knowledge*, vol. 29, No. 989.)

"The results of the experiments must not be considered in anywise as evidence in favour of a decreased rather than an increased ventilation of ordinary living rooms, lecture halls, and public buildings. The great advantage to all in breathing plenty of pure fresh air cannot be denied by any one. The germicidal properties of atmospheric air and sunlight are of the utmost importance in conserving our health.

"If these experiments throw any more light upon the vexed problems of ventilation and emphasise the importance of determinations of moisture rather than of carbon dioxide, they will have been productive of good results. It is certainly erroneous and unscientific to rely upon the determination of carbon dioxide in the air of a room as a measure of its condition for respiration. The quantity would become serious, of course, when large enough to dilute the air to such an extent that the quantity of oxygen present would be insufficient for daily needs; but it can never accumulate to a serious degree in any ordinary room in which proper attention is given to the regulation of the moisture content and temperature." (Benedict and Milner, *U. S. Department of Agriculture. Bulletin 175* (1907).)

In order to secure efficient ventilation, a standard allowing 9 volumes of carbon dioxide in 10,000 was recommended by Sir Henry Roscoe's Committee in 1907. Since this recommendation was made, it has been clearly demonstrated by the evidence of the workers and of the scientific witnesses that although ventilation is an important factor, there is a still more important one, namely, the height of the wet bulb thermometer. Any inducement or encouragement to lessen the amount of artificial humidity introduced into weaving sheds will add materially to the comfort of the operatives. The oftener the air is changed, especially when dry meteorological conditions prevail, the more moisture must be introduced. It is thought that the weighty evidence and arguments quoted in the body of the report, justify the Committee in recommending that for humid weaving sheds the standard of ventilation should in future be 12 volumes of carbon dioxide per 10,000, or 8 volumes in excess of the outside air, whichever is the greater.

During the period of the day affected by the use of gas or oil for illuminating purposes, it is suggested provisionally that a standard of 20 volumes of carbon dioxide in 10,000, or 16 volumes in excess of the outside air, whichever is the greater, should be adopted, but inasmuch as little definite evidence is forthcoming as regards the amount of carbon dioxide actually found in weaving sheds under these conditions, it is recommended that a series of tests should be taken during the present winter, special attention being given to places where owing to the nature of the work particularly good lighting is essential, and in the opinion of the representatives of the manufacturers and operatives on the Committee, it is desirable that this work should be entrusted to a chemist commanding confidence on both sides.

It is by no means thought that this standard or the standard hereafter to be proposed for "dry" sheds should be taken as a precedent for other trades; the Committee recognises that nature is the best guide, and that the nearer the atmosphere of a work-room can approach natural conditions, the better for the workers. On the other hand, they have before them the choice of the lesser of two evils, less temptation to introduce artificial humidity at the expense of slightly diminished ventilation, and it is believed in view of the scientific evidence that this moderate change in the hitherto accepted standard will not be detrimental to health.

It is felt by the Committee that the time has now arrived for submitting the general conclusions arrived at by them; the members, however, desire to point out that on one all-important detail, namely, the maximum limit of the wet bulb temperature, the evidence excepting the physiological evidence at present before them hardly justifies them in coming to a final conclusion.

They are unanimously of opinion that the discomfort and possible injury to health, complained of by the operatives, can best be met by fixing a maximum limit of wet bulb temperature, and by securing within the limits retained a difference between the wet and dry bulb temperatures sufficient to prevent the deposit of moisture, but considerations other than those of health and comfort cannot be ignored. For satisfactory weaving according to the weight of evidence, the temperature should be about 65° to 70° F., and the relative humidity 78 to 80 per cent.; in order to retain this relative humidity without excessively raising the wet bulb temperature, the temperature in the humid sheds must in summer be considerably reduced, and it yet remains for the Committee to determine by experiment or otherwise how far practical effect can be given to the cooling necessary to bring this about.

All manufacturers of humidifying plant have been communicated with and enquiries as to the best cooling methods have been made, not only at home, but abroad, and the replies received justify the Committee in hoping that, without prohibitive outlay, the difficulty may be solved.

The Committee finds that the efforts of makers of ventilating and humidifying plant and of manufacturers have been directed chiefly to the question of supplying to the sheds the desired amount of humidity, and at the same time keeping the air at the legal standard of purity, whilst little attention has been given to the problem of controlling the temperature of the shed in hot weather.

Various suggestions for dealing with this question have been considered by the Committee, and of these the following are the chief:—

(1) That the use of saturators should be introduced generally.

In sheds ventilated on the plenum system a matting saturated with water should be placed in the inlet channel, so that the air passing through to the shed would by evaporation of the water in the matting become cooled and saturated at the same time. The available cooling effect in any given case may be estimated by observing the difference between the dry and wet bulb temperature of the outside

air. This difference in the hot weather of summer is seen to amount to as much as 17° F. The following table gives examples of the readings of the wet and dry bulb thermometers on some of the hottest days during 1908 at 3 p.m.:—

Date.	Darwen.			Stonyhurst.		
	Dry.	Wet.	Difference.	Dry.	Wet.	Difference.
June 3rd - - -	72.6	62.5	10.1	75.6	66.7	8.9
" 26th - - -	70.0	63.8	6.2	74.0	66.7	7.3
" 29th - - -	73.0	62.9	10.1	74.8	65.5	9.3
" 30th - - -	71.2	57.9	13.3	74.0	60.1	13.9
July 1st - - -	75.2	59.7	15.5	77.1	62.4	14.7
" 2nd - - -	78.5	64.9	13.6	83.0	66.0	17.0
" 3rd - - -	71.5	62.8	8.7	74.7	64.0	10.7
Sept. 30th - - -	72.9	65.2	6.7	—	—	—

At present in sheds humidified by steam the ventilating apparatus is generally without this device, and this leads to the following result: The temperature of the shed rises during the day with the outside temperature. As this takes place, it being necessary to keep up the percentage of humidity for weaving purposes, more steam is introduced, and the introduction of steam tends to raise the wet bulb temperature still higher. By the method proposed, full advantage would be taken of the comparatively rapid rise of the dry bulb temperature during the day to humidity by a cooling process, the evaporation of water from the saturator.

Some experiments conducted by Mr. Wilkinson Hartley, a member of the Committee in Albert Mills, Nelson, are encouraging in this respect, since they show that, by the use of a saturator, it was possible to reduce the temperature of the incoming air by an average of 7.9° F. during July, and 6.4° during August (Appendix XVII., Table B.).

Other similar methods depending on the evaporation of water or involving the use of refrigerating plant might also be suitable for the purpose of cooling the shed.

(2) Another evil to which attention must be drawn, is the practice of placing the air intake in the roof of the shed. The heat of the shed escapes at all times chiefly through the roof, and warms the stratum of air from which the inlet current is in these cases drawn. The hotter the shed, the hotter becomes this stratum, and as the warmest days are generally very still and free from air currents, this arrangement results in unduly heating the fresh air supplied to the shed.

Thus the experiments conducted by Mr. Wilkinson Hartley (Appendix XVII.) indicate that the excess of the temperature of the air in the inlet channel over the true shade temperature at 5.30 p.m. during July and August consisted on the average of 6.9° F., and amounted on the 14th August to as much as 22°.

The investigations carried out by Mr. William C. Jenkins, of the Godlee Observatory, Manchester (Appendix XVIII.), are confirmatory of the fact that the temperature of the air immediately over the roof of a shed is often far higher than the shade temperature.

If the inlet were so placed that the incoming air had the true shade temperature, great benefit would result.

(3) In the hot weather of summer it has been found that the early morning records of the shed temperatures are sometimes unduly high. Thus in one mill the records for two days were as follows:—

		7 to 8 a.m.		10 to 11 a.m.		3 to 4 p.m.	
		Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
July 2nd	- -	84	76	88	80	92	83
July 3rd	- -	84	75	88	77	90	80

It is clear that during the warm weather the sheds are not thoroughly cooled during the night, and are even at the beginning of the day unduly hot; they therefore reach high temperatures earlier in the day than would be the case if they were cooled down as far as possible during the night.

Mr. T. Roberts, a member of the Committee, has investigated this point in four sheds with different makes of humidifier (see Appendix XIX.), the object in view being to discover the relation between the outside and inside temperatures, and especially to find out the extent to which a shed cools down during the night.

Hourly records of the outside and inside wet and dry bulb temperatures were kept during the whole of one week, including Sunday; the diagram shows clearly that the curves representing the inside and outside temperatures during the night

are roughly parallel, indicating that there is a constant difference between the two, and that the inside temperature decreases no faster than the outside.

At 6 a.m. the shed temperature is always about 10° higher than the outside, and it is probable that were this difference extinguished during specially hot weather—for instance, by ventilation of the shed during the night—it would be found easier to keep the day temperature within reasonable limits.

(4) The white-washing of the roofs should be more efficiently carried out and maintained. In many instances it was noticed that the roofs were white-washed in name only, and certainly not sufficiently thoroughly to achieve the object aimed at.

(5) More attention should be given to the covering of the steam-pipes. In many sheds it was observed that the covering was in very bad repair, long portions of bare pipe being completely exposed. Apart from this the material of which the covering is made must doubtless be of great importance in minimising the amount of heat involved.

It is felt by the Committee that in order to bring about the requisite cooling in hot summer weather, it might be necessary to adopt all these proposed methods, but in the absence of actual observations on the mode in which these suggestions can be carried out, it is impossible to give recommendations in the practical form which is desirable.

All the above observations have been confined to a very small scale, but the Committee does not feel justified in keeping back the report until more exhaustive experiments have been made; it is hoped, however, that arrangements may be made on the lines now suggested for these to be conducted in the course of the ensuing summer.

It is thought advisable that, without unnecessary delay, arrangements should be made with occupiers of representative weaving sheds for experiments to be made on a large scale, in which the various ventilating engineers should be invited to co-operate, that these experiments should be subject to the control of the Committee, who should have power to depute a certain number of their members to be present at all preliminary experiments, but that no conclusions should be arrived at except by the Committee as a whole.

It is further suggested that the work of taking the body temperatures begun by Dr. E. Collis, H.M. medical inspector of factories, but stopped, it is understood, owing to a sudden change in the weather, should be continued; if Dr. Collis would obtain from the Secretary to the Committee a list of sheds where the temperature is abnormally high and would visit these sheds during the hottest days in spring and summer, some definite information would be obtained as to the physiological effects of working in damp atmospheres at high temperatures.

While it is anticipated that the results of these observations will be of great interest, it must be remembered that it is especially important that the body temperatures should be taken on the hottest days of the summer, and since it would be impossible for one observer to visit more than two or three mills in a day, it is suggested that, with a view to obtaining the greatest possible number of observations, the co-operation of the medical officers of health of the boroughs chiefly concerned should be invited, that they should be requested to visit certain sheds on the hottest days, approval having been previously obtained from the occupiers, and that the method of procedure should be under the supervision of Dr. Legge, H.M. Medical Inspector of Factories.

Reference has been made to experiments on this question, conducted by Dr. Haldane, but it would probably be more satisfactory were the subjects of the experiments operatives actually engaged in their usual work.

Although "steaming" is the term generally used when reference is made to artificial means of humidifying, it must be clearly borne in mind that this system is by no means universal; it has been largely superseded by appliances for introducing "atomised" water into the sheds in place of steam, and frequently the same mechanism is used for the double purpose of ventilating and humidifying.

The infusion of live steam, though having little effect on the dry bulb temperature, raises the wet bulb temperature very considerably, and there is no doubt that this system of humidifying is the most unpopular among the operatives. As bearing on this point, two passages may be quoted from Sir Benjamin Dobson's "Humidity in Cotton Spinning," published in 1897:—

"It (live steam) is exceedingly unpleasant to the persons working in the room, and, I think is generally admitted, very injurious to their health. It is therefore undesirable from every point of view, and, as proper conditions of the air can be so easily arranged in other ways, there would seem to be little excuse for a continuance of this practice" (p. 46).

Again, speaking of Sir Henry Roscoe's Committee, he says:—

"I may say that some of the witnesses did not object to the escape of live steam into the sheds. In this they may be right or wrong, but I maintain more strongly than ever that this method of damping is injurious, more costly than any other means, and not as desirable from a manufacturing point of view" (p. 93).

Of systems other than the introduction of live steam, the following are known to exist, and of these those marked with an asterisk have been witnessed by the Committee in operation:—

British.

- *Dargue, Griffiths & Co., Ltd., 51, North John Street, Liverpool.
- *J. A Hart, Commercial Mills, Blackburn.
- *Hall & Kay, Ltd., Stockport Road, Ashton-under-Lyne.
- *Manchester Patent Ventilating and Damping Machine Co., 21, Dickinson Street, Manchester.
- *Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.
- *Mather & Platt, Ltd. (Vortex system), Park Works, Manchester.
- *Haworth & Co., Ltd., Farnworth, Bolton.
- Heenan & Froude, Ltd., Worcester.
- *Parson Humidifier Co., Phoenix Mill, Blackburn.
- *Pye's Humidifier Co., Blackburn.
- Jas. Stott & Co., Vernon Works, Oldham.

Foreign.

- *Hygrofor Humidifier; *Drosophore Humidifier; *Paul Kestner, 17, St. Ann's Square, Manchester; Sconfiatti Humidifier.

From personal observation and from the evidence taken, it appears that greater comfort is enjoyed by the workers when a system of humidifying by "atomised" water, rather than by the introduction of steam, is in use. It is believed that by this system the excessive heat complained of in summer is to some extent reduced.

The Committee is further of opinion that the whitewashing of the roofs required by the Act of 1901 should be maintained more efficiently, so as to cover every part of the roof, including the windows, that it should be made compulsory for "dry" sheds as well as for humid, and that the period should be extended to the end of September.

Statistics were prepared from the humidity records with a view to showing the effects of different makes of humidifiers on shed conditions, and appear in Appendix XVI.

In dealing with the ventilation of what are known as "dry" sheds, a long-standing difficulty has to be faced. In the districts of Burnley, Nelson and Colne, where these sheds chiefly are found, the introduction of humidifying with a standard of nine volumes of carbonic acid in 10,000 would, it is generally believed, be welcomed by the manufacturers, but the operatives have steadily refused to work in these sheds if artificial humidity is introduced. On this account it has been so far impossible to fix a standard of ventilation.

No evidence has been produced demonstrating the existence of exceptional ill-health among the workers in dry sheds; on the contrary, it is the opinion of some medical witnesses, with large local experience, that the dry sheds are more healthy than the humid.

The carbon dioxide found in these sheds in winter is, on the average, about 16·5 volumes in 10,000, but in certain exceptional sheds this average is very much exceeded, and it is desirable to legislate for such places.

The published statistics and the personal investigations of the Committee show rather to their astonishment that the ventilation of "dry" sheds, as measured by the carbonic acid standard, is, generally speaking, much more satisfactory than was anticipated. It was supposed that, owing to respiration and lack of efficient ventilation, the proportion of carbon dioxide would reach far higher proportions than investigation has disclosed, the actual average for the winter months being 16·5 volumes in 10,000. On the other hand there are numerous sheds that show a consistently high proportion, and there appears to be no sound reason why a standard of ventilation should not be required in "dry" sheds as well as in humid.

Ventilation
of dry
sheds.

Questions
455-458.

In the opinion of the Committee it has been clearly proved that work in moist atmospheres at high temperatures is really and seriously uncomfortable for the workers, and possibly in the long run injurious to their health. They think that if, in places where no artificial humidity is introduced, a standard of 15 volumes of carbon dioxide in 10,000, or 11 volumes in excess of the outside air, whichever is the greater, is allowed during daylight, there will be a strong inducement for manufacturers now introducing humidity, to discontinue its use, and they are further of opinion, after the evidence quoted in this report, that the standard suggested will not cause injury to the workers.

During the period of the day affected by the use of gas or oil for illuminating purposes it is suggested, on the analogy of the standard already proposed for humid sheds, that a standard of 23 volumes of carbon dioxide in 10,000, or 19 volumes in excess of the outside air, whichever is the greater, should be adopted provisionally, but in view of the lack of data as to the amount of carbonic acid actually present in "dry" sheds during periods of artificial illumination, it is recommended that determinations should be made in certain of such sheds in the course of the present winter, and a new standard formulated if necessary on the results obtained.

In dry sheds it does not appear that mechanical ventilation is in general use, although in a few works plenum and exhaust fans were found, but these are seldom used in winter. Natural ventilation, that is to say, such ventilation as can be secured by windows and apertures that can be opened and closed, seems to be considered sufficient, and it is somewhat astonishing under such conditions that the atmosphere in these sheds, especially in winter, does not show worse results than those given.

In certain works in the Nelson district a method of mechanical ventilation was tried; instead of having a limited number of plenum fans running at high speed, a large number of smaller fans running at low speed were installed, and it was assumed that when running at low speed the draught would be inappreciable. This, however, was not the case; the workers complained and the fans were stopped. Evidently the cause of the discomfort arose from the fact that the air at a low temperature, and in the form of draught, impinged on the persons employed, had the incoming air been previously passed over radiators, and had care been taken to prevent a direct draught from falling on the workers, the results would presumably have been different.

In the opinion of the Committee it is desirable that, following the precedent of the regulations for the spinning and weaving of flax, for the spinning and weaving of hemp and jute, and for wool sorting, which require that

"No person employed shall be exposed to a direct draught from any air inlet or to any draught at a temperature of less than 50° F."

it should be enacted that arrangements shall be made that no person employed shall be exposed to a direct draught, and that the incoming air from the ventilating inlets shall be warmed sufficiently to ensure the comfort of the workers and to obviate risk of chill.

Finally, the Committee concurs in making some further recommendations in connection with certain matters, which, although not directly referred to them for consideration, have nevertheless an important bearing on the health and comfort of the operatives.

Though questions connected with the purity of water used for the generation of steam in the weaving sheds do not form a direct part of the reference, it is obvious that no system of ventilation can be efficient, unless means are taken to prevent the introduction with the steam of organic impurities, whether volatile or otherwise. Attention was called to this in the Report of the Roscoe Committee, but complaints have been made from time to time by the operatives leading to special enquiries by the inspecting staff.

Section 9 (1) of the Act of 1901 requires that "The water used for the purpose of producing humidity shall either be taken from a public supply of drinking water or other source of pure water, or shall be effectively purified to the satisfaction of the inspector before being introduced in the form of steam into the factory, and all ducts for the introduction of humidified air shall be kept clean," but there has been considerable divergence of opinion as to what may be considered pure water, and whether it is sufficient to require that water shall be effectively purified to the satisfaction of the inspector. Pure water does not exist in nature, and different inspectors may hold different views in regard to what should be done to secure that the water is effectively purified.

Steam from water in boilers filled from an impure source may, it is said, carry with it into the sheds volatile organic matter. It has been suggested that this could be detected by the sense of smell, but it would be very difficult to convince a bench of magistrates that an infringement of this requirement had occurred if the evidence consisted solely of the opinions of the two parties on this point.

Question 7455.

Dr. Ransome, in his evidence given before the Committee, stated that he and Sir Henry Roscoe were of opinion that the word "potable" should be used in defining the water for humidifying; the Committee, however, foresees difficulties in the adoption of this suggestion, since in districts without a public supply, where the drinking water is necessarily procured from wells, or similar sources, it might be held that such water is to be considered as the potable water of the district, although unsuited for use as the humidifying agent.

In many mills where the cost of town's water for use in boilers is prohibitive, or where pure water is unavailable, a device known as a second boiler has been adopted; this boiler is filled with town's water, or the purest water available, and is heated by steam pipes from the main boiler, the steam generated in the small boiler being used solely for humidifying. An unfortunate but solitary accident, due probably to some neglect, and entailing the bursting of one of these small boilers, did much to discourage the introduction of this useful appliance.

With the assistance of Mr. Frank Scudder, F.I.C., and after much consideration, a standard of purity for the water to be used for humidifying purposes was agreed upon between the Home Office and the Manufacturers' Associations, and this has been the guide since that time. After securing technical advice the same standard was accepted as satisfactory by the Belfast Flax Spinners' Association, and was embodied in the regulations made in 1906 for the processes of spinning and weaving flax and tow (Statutory Order, 1906, No. 177). The regulation referred to is the following:—

"No water shall be used for producing humidity of the air . . . which is liable to cause injury to the health of the persons employed or to yield effluvia: and for the purpose of this Regulation any water which absorbs from acid solution of permanganate of potash in four hours at 60 degrees more than 0.5 grain of oxygen per gallon of water, shall be deemed to be liable to cause injury to the health of the persons employed."

It is recommended by your Committee that this standard should be adopted as the legal standard for water used for humidifying in cotton cloth factories, and that in the case of water taken from a source other than a public supply, periodical tests as to its purity should be made, especially during the summer months.

Cloak-rooms.

The recommendations made by Sir H. Roscoe's Committee relating to the provision of cloak-rooms appear to have added to the general comfort of the workers, but a very large number of sheds remain in which no such legal requirement exists; in these the clothing not worn during working hours is frequently hung up on the pillars and against the outside walls, when in humid sheds, especially owing to condensation, it is liable to become damp and unsuitable for wearing when leaving hot rooms to go out into a cold atmosphere.

To require cloak-rooms for the use of all workers employed in humid weaving sheds would appear to be a reasonable solution, but practical difficulties exist. In many of the older mills it is impossible to find sufficient space for the erection of suitable cloak-rooms, and rooms other than suitable will not be used by the workers. It is essential that these rooms shall be constructed in such a way that there shall be no delay in going to or from work, that the clothing can be hung up in passing, and that there shall be suitable partitions between the pegs used by each worker, in order to avoid contact between the clothing of the majority of the workers and that of a small minority careless in their habits. It is furthermore necessary that due precautions should be taken to prevent pilfering; such cases, though happily rare, are on record.

As an alternative to cloak-rooms, it is thought that Clause II. of the regulations for the spinning and weaving of flax and tow, which reads as follows:—

"There shall be provided for all persons employed in any room . . . in which artificial humidity of air is produced in aid of manufacture, suitable and convenient accommodation in which to keep the clothing taken off before starting work, and in the case of a building erected after 30th June, 1905, in which the difference between the readings of the wet and dry bulb thermometers is at any time less than 4 degrees, such accommodation shall be provided in cloak-rooms in or near the workrooms in question,"

might with the necessary modifications with advantage be made to apply to cotton cloth factories.

Attention has been paid by the Committee to the present methods of recording the readings of the wet and dry bulb thermometers. The following statement made by Mr. L. K. Thomas, Clerk for Factory Statistics, will show that an extraordinary amount of labour is entailed without a corresponding useful result:—

“ For the whole year 1907 33,590 records of humidity, containing nearly 2,100,000 pairs of (wet and dry bulb) thermometer readings, were received. The reported instances of excessive humidity numbered 1,199, but many were apparent only and were really due to neglect of hygrometers, or error in reading them, or in recording the readings. Approximately there were 1,730 pairs of apparently correct entries for each instance of apparent irregularity. The records have to be made in duplicate (s. 92 (2c.).).

“ The work undertaken at the central office (viz., registration of occupiers, checking receipt of the records, making application for belated records, examinations of the entries, forwarding to the district inspectors the records showing instances of irregular readings or altered particulars as to cubic capacity, etc., and other incidental work) occupies the time of four clerks for one week each per month. This is the equivalent of one clerk's whole time on the work.

“ One quarter of the work is done by a second division clerk, the rest by junior clerks.

“ On receipt of a record showing contravention, it is the district inspector's duty to give the statutory notice (s. 95) to the occupiers concerned.

“ The particulars of cubic capacity contained in the records have some value, but there is little advantage in repeating them monthly.”

The evidence before the Committee has clearly shown that on the part of the operatives there is little confidence in the reliability of the records; it is not suggested that inaccurate records are wilfully made, but it is thought that errors are not uncommon owing to want of care in regard to the temperature and purity of the water, the adjustment of ventilators, and the condition of the wicks and bulb coverings. Complaints on this score have been made from time to time to the inspectors and to the Home Office, and it has been pointed out that the hygrometers are in a position accessible to all, that the readings are taken in the presence of the workers, and that it is competent for any worker to check their accuracy for himself. Such a course, however, has its dangers to the workman, and your Committee, after consideration, is of opinion that methods should be devised whereby the readings would be made to command the confidence of all concerned which would at the same time do away with an enormous amount of unnecessary clerical work both in the mills and at the Home Office.

It is suggested that in each shed there should be a duly elected or accredited representative of the operatives, whose duty it should be to take the readings of the hygrometers in company with the mill manager or other representative of the employer. It is further suggested that the readings should be taken three times a day as at present, but between 11 and 12 instead of 10 and 11 in the morning, and between 4 and 5 instead of 3 and 4 o'clock in the afternoon, since the temperature rises continuously throughout the day; it would, however, of course be open to either representative to take readings at any other time. Instead of the records placed near the thermometers, a register should be kept in the office, in which an entry should be made at the end of each week, signed by both representatives, certifying that no excess has been observed, and in the event of any excess being noticed, that fact should be recorded, and notice to that effect sent to the Home Office. The necessary details could probably best be arranged by a conference between official representatives of the Employers' and Operatives' Associations.

By this arrangement it is thought that the enormous number of entries mentioned above, which are of little value, could be dispensed with.

Could a satisfactory self-recording hygrometer be found, not only would the difficulties described above be done away with, but much additional labour would be saved. Numerous and exhaustive enquiries have been made as to whether such an instrument exists or could be made, but no practical answers have been received, the only self-recording hygrometers being delicate and sensitive instruments which would be affected by dust and vibration caused by machinery, and generally unsuited for weaving sheds.

In the opinion of the Committee, more useful and reliable results would be obtained, were it laid down that the hygrometers for the time being in use should be of some standard pattern to be approved by the Secretary of State, the conditions of approval being that the water used for moistening the wicks should be distilled water, and should have been kept in the shed sufficiently long to attain the temperature of the shed before being placed in the receptacle, that ample protection should be given to prevent the moisture in the neighbourhood of the wet bulb affecting the dry bulb thermometer, and that each hygrometer should be provided with a certificate of accuracy from Kew, or from manufacturers of recognised standing.

Steam-
pipe
covering.

The general impression amongst the workers is that steam not only produces the discomfort before referred to, but adds considerably to the heat so much complained of in summer. It is difficult scientifically to accept this theory; the work done by the steam in expanding at high pressures should absorb more heat than is given off. As pointed out by Sir H. Roscoe's Committee, the additional heat is caused by the pipes through which the live steam is conveyed into the shed.

Section 94 (2) of the Factory Act of 1901 lays down that,

"The pipes used for the introduction of steam into a cotton cloth factory in which the temperature is 70 degrees Fahrenheit or over shall, so far as they are within the shed, be as small both in diameter and length as is reasonably practicable, and shall be effectively covered with non-conducting material to the satisfaction of the inspector, so as to minimise the amount of heat thrown off by them into the shed."

Questions have from time to time arisen as to what is "reasonably practicable" in regard to the diameter of the pipes, and after various consultations it was accepted by the Home Office that pipes having a diameter of not more than one inch for new pipes and two inches for pipes already in position would come within the definition. Your Committee would recommend that this limit should be continued, unless on further inquiry some practical modification should be suggested.

The Committee, whilst recognising the practical impossibility of requiring any specific method or material to be used for pipe covering, is of opinion that greater attention should be given to this point. Experiments should be made from time to time to discover whether the covering in use does actually perform the work intended, and, if not, by adopting some other system, or by increasing the thickness of the covering, the evil complained of might be remedied.

The non-conducting material should in many instances be kept in better repair than at present; in several of the sheds lengths of exposed piping were noticeable.

It is hoped that the questions relating to steam-pipe covering may be further investigated during the ensuing summer.

Legal
proceed-
ings.

The evidence will show that complaints have been made in regard to the procedure necessary before legal proceedings can be instituted. According to Section 95 of the Factory Act of 1901, on discovery of a contravention of or non-compliance with any provision relating to humidity in cotton cloth factories, statutory notice must be given to the occupier, and only if the offence is repeated within twelve months after such notice, can proceedings be taken against the offender.

Whilst recognising that contravention of many of the provisions may be due to temporary and unavoidable causes, and that therefore preliminary notice is desirable, the Committee is of opinion that the period of twelve months after such notice is too short, and that it should be extended to two years, thus bringing it to some extent into line with the other penal sections of the Act.

Summary
of Recom-
mendations.

In the opinion of the Committee the comfort and probably the health of the workers in cotton cloth factories can best be secured by the adoption of the following recommendations:—

(1) That in view of the generally expressed opinion of physiologists that the health and comfort of the workers is dependent on the wet bulb temperature, rather than on the dry bulb temperature, or the relative, or the absolute humidity, a limit of temperature on the wet bulb thermometer be fixed at which all admission of artificial humidity shall cease, this limit to be decided by early experiments and to be the lowest necessary for efficient weaving.

(2) That the present schedule of humidity be amended by eliminating all temperatures above the maximum wet bulb reading to be hereafter determined and all temperatures below 50° F., on the dry bulb, and that a minimum difference between the readings of the wet and dry bulb thermometers be fixed when the maximum wet bulb temperature has been decided.

(3) That with a view to encouraging the abolition of the use of artificial humidity, the standard of ventilation in humid sheds be altered from nine to twelve volumes of carbon dioxide in 10,000, or eight volumes in excess of the outside air, whichever is the greater, during daylight, and, pending the result of further investigation, to twenty volumes in 10,000, or sixteen volumes in excess of the outside air, whichever is the greater, during the period of the day affected by the use of gas or oil for illuminating purposes.

(4) That in "dry" sheds (in which there has hitherto been no standard), a standard of 15 volumes of carbon dioxide in 10,000, or eleven volumes in excess

of the outside air, whichever is the greater, be adopted during daylight, and pending the result of further investigation, 23 volumes in 10,000, or 19 volumes in excess of the outside air, whichever is the greater, during the period of the day affected by the use of gas or oil for illuminating purposes.

(5) That following the precedent of regulations relating to the spinning and weaving of flax and tow, the spinning and weaving of hemp and jute, and wool-sorting, provision be made to prevent direct and cold draughts from impinging on the workers.

(6) That a standard of purity be fixed for water to be used for the purpose of humidifying.

(7) That in places where there are no cloak-rooms, better arrangements be made for the accommodation of the clothing of the workers.

(8) That in order to secure general confidence, the readings of the thermometers be taken jointly by representatives of the employer and employed, and that a statement relating to these readings be entered in a register to be kept at the works and to be examined by H.M. Inspectors of Factories, but that records be sent to the Home Office only when irregularities are found, and that the practical details be settled by conference between official representatives of the Manufacturers' and Operatives' Associations.

(9) That power be given to the Secretary of State to prescribe a standard hygrometer, that distilled water only be used, kept sufficiently long in the shed to acquire the shed temperature, and that provision be made to prevent the wet bulb moisture affecting the dry bulb thermometer.

(10) That the present understanding in regard to the size of steam-pipes be continued until after further enquiry, and that more attention be paid to the efficiency and maintenance of the non-conducting covering.

(11) That the law relating to cleanliness of the floors and walls be more rigidly enforced.

(12) That the white-washing of the roofs be more efficiently carried out so as to cover every part of the roof, including the glass of the windows, that the provision be made compulsory for all weaving sheds and that the period be extended to the 30th September in each year.

(13) That Section 95, relating to legal proceedings, be amended by extending the period of 12 months to 24 months.

It is anticipated by the Committee that their recommendations in regard to the standard of ventilation will by some be considered retrograde. In their decision they have been influenced by the evidence of eminent physiologists and by the personal experiences of the vast number of operatives immediately concerned, and they are of opinion that, although it is desirable to approximate as nearly as possible to natural conditions, yet when trade exigencies do not permit of this, it is better to have a standard capable of doing much good rather than no standard at all.

They have further borne in mind that the interests of one of our largest industries should be considered and that manufacturers should not be called upon to maintain ventilating plant at enormous expense, unless it can be clearly shown that this is necessary for the well-being of the workers.

In certain branches of the textile trade alone has a standard of ventilation been fixed, and it is perfectly well known that throughout the country in indoor occupations, especially in winter, the standard now proposed is often enormously exceeded.

To the many witnesses who frequently at considerable loss of time and personal inconvenience have attended to give evidence the warmest thanks of the Committee are due.

The evidence given by H.M. Inspectors of Factories, namely Mr. W. Williams, late Secretary of Sir Henry Roscoe's Committee, Mr. J. H. Rogers, Mr. D. Walmsley, Mr. G. A. Taylor, Mr. C. E. Pringle, and Miss M. M. Paterson, all of whom have had long experience of cotton cloth factories, has not been specially referred to in the body of the report, although published in full elsewhere, since the views generally expressed by them have already appeared in official documents, but the value of their evidence is fully appreciated by the Committee.

The Committee with the deepest regret places on record the death of their colleague, Mr. Henry Higson, Chairman of the North and North-East Lancashire Manufacturers' Association. His knowledge, courtesy, and conciliatory bearing were most valuable to the Committee, and were recognised by you in communica-

tions written by the Chairman on your behalf to the North and North-East Lancashire Manufacturers' Association and to Mr. Higson's widow and relations.

Seeing that at the time of the death of Mr. Higson the proceedings of the Committee had reached a very advanced stage, it is thought unnecessary, so far as regards the present report, to recommend that a member should be appointed in his stead; the points, however, yet to be settled are of a technical character; and in the opinion of the Committee their efforts would be materially assisted, if an efficient engineer of scientific attainments were added to their number.

We have the honour to be,

Sir,

Your obedient servants,

H. P. FREER-SMITH (*Chairman*).

JOSEPH CROSS.

WILKINSON HARTLEY.

THOMAS ROBERTS.

D. J. SHACKLETON,

J. LORRAIN SMITH.

FRED THOMAS.

DUNCAN R. WILSON,

Secretary.

1909.
HOME OFFICE.

DEPARTMENTAL COMMITTEE

ON

HUMIDITY AND VENTILATION IN COTTON WEAVING SHEDS.



MINUTES OF EVIDENCE

AND

APPENDICES.

Presented to both Houses of Parliament by Command of His Majesty.



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ETHIOPIAN COMMITTEE

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24	FRED THOMAS - - - - -	" Burnley " " - - - - -	2049-2184
25	WILLIAM NABB - - - - -	" Bury and Radcliffe Weavers' Association -	2185-2263
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35	Moir, William, M.B. - - - - -	93	3224-3309
25	Nabb, William - - - - -	60	2185-2263
75	Nutter, Thomas - - - - -	165	5893-5971
27	Ogden, John - - - - -	66	2386-2500
47	Paterson, Mary Muirhead - - - - -	126	4184-4270
48	Patrick, William, M.D. - - - - -	129	4271-4340
39	Pembrey, Marcus Seymour, M.A., M.D. - - - - -	107	3615-3709
7	Pringle, Charles Eric - - - - -	25	737-860
96	Ransome, Arthur, M.D. - - - - -	203	7425-7577
9	Rogers, John Henry - - - - -	32	1014-1084
36	Scarisbrick, Frederick - - - - -	96	3310-3477
1	Scudder, Frank, F.I.C. - - - - -	1	1-120
66	Seal, William Henry - - - - -	151	5225-5380
44	Stones, Samuel - - - - -	120	3946-4051
10	Taylor, George Allen - - - - -	35	1085-1152
95	Taylor, John - - - - -	198	7259-7424
29	Temple, Robert - - - - -	74	2661-2747
24	Thomas, Fred - - - - -	57	2049-2184
84	Turner, Charles Henry - - - - -	179	6460-6542
43	Walker, Alfred T. - - - - -	120	3946-4051
8	Walmsley, David - - - - -	28	861-1013
38	Wheatley, James, M.D. - - - - -	104	3560-3614
6	Williams, William - - - - -	21	610-736
52-56	Weavers (Glasgow) - - - - -	139	4619-4829
58-60	" " - - - - -	144	4870-4997
62-65	" " - - - - -	148	5070-5224
11-21	" (Lancashire) - - - - -	37	1153-1873
77-80	" " - - - - -	171	6070-6300
82-83	" " - - - - -	177	6385-6459
85-94	" " - - - - -	181	6543-7258
67-74	" (Yorkshire) - - - - -	156	5381-5893

MINUTES OF EVIDENCE

TAKEN BEFORE

THE HOME OFFICE COMMITTEE

ON

HUMIDITY IN COTTON-WEAVING SHEDS.

FIRST DAY,

Monday, 6th January, 1908.

At Manchester.

PRESENT :

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
Mr. H. HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

Mr. FRANK SCUDDER, F.I.C., called and examined.

1. (*Chairman.*) Mr. Scudder, I think, although we all know, formally we had better have your full name and professional qualifications and what official appointments you hold?—Frank Scudder. I am a Fellow of the Institute of Chemistry of Great Britain and Ireland and a Fellow of the Chemical Society of London. I was for nine years private assistant to the late Doctor Angus Smith, who was Government Inspector of Alkali and Chemical Works, and for 18 years I have acted as chief scientific assistant to Sir Henry Roscoe, and I am still associated with him in scientific work. I am a professional consulting chemist practising in Manchester.

2. I think you have conducted various inquiries and analysed various samples of air for the Home Office at different times?—Yes, I have done so. I made a report, which is no doubt familiar to you all, in 1904.

3. Intituled?—Report on Air Tests in Humid Cotton-Weaving Sheds.

4. That report, I think, referred to the condition of the atmosphere as measured by the CO₂ test?—That was so; that was the only point referred to me.

5. The question of humidity has not so far, I think, been officially referred to you?—No, sir; not at all.

6. Have you seen the terms of reference for this Committee?—I have seen various reports in the newspapers, and if I understand those reports rightly it refers solely to the question of humidity in weaving sheds.

7. We will just read to you the terms of reference.

(*The Secretary read the terms of reference.*)

(*Witness.*) That is the first time I have heard the full instructions given.

8. (*Chairman.*) Now the point that really concerns us most, at any rate one of the things that comes first on our agenda paper, is the question of humidity, and not only humidity, but the very great temperatures that are found or are said to be found in weaving sheds, especially during the summer. Of course we know, we must know that there are different schools of thought; that some people hold that the amount of moisture that is now authorised by the Act of Parliament does not act injuriously on the health of the workers; on the other hand, there is a very large

number of people, I believe, including the workers themselves, who are practically unanimous in their opinion that steaming is injurious to health and that they suffer. It is a very big question and a very difficult question, and I think the first step towards it would be this. We have before us a humidity table that is found in the Act of Parliament, but I personally am not able to say how this table was drawn up. I do not know if any other gentlemen here know; but we have thought that you were intimately associated in the drawing up of this table, and that perhaps you would be able to explain to us on what basis it was drawn up—whether there were any experiments made at different temperatures as to what the effect would be on the yarn from a manufacturing point of view; whether there were any inquiries made as to the effect on health of different temperatures under different conditions, or exactly what was running in the mind of the framers of this table when it was drawn up. I have expressed myself to the best of my ability. It is quite possible I may be wrong in some detail, and before Mr. Scudder answers will you correct me in anything that you like.

9. (*Mr. Higson.*) I do not think there is anything. That was the point at which we adjourned, so that we might ascertain the basis upon which this table was formulated.

(*Witness.*) I do not think I can answer that question better than by referring you to Sir Henry Roscoe's own words. He has recently written his Autobiography, and he treats in Chapter XII. of the history of this subject, and I think if I read you that paragraph it will indicate to you upon what basis he framed that schedule which is now in operation. It is Chapter XII., page 300, of "The Life and Experiences of Sir Henry Roscoe, 1906" (Macmillan & Co.): "As a Lancashire member I attended, in 1888, a meeting at the Westminster Palace Hotel of the Lancashire mill-owners and operatives, to discuss the question of the use of steam in the cotton-cloth weaving sheds. Great complaints had been made by the operatives that their health was injured by the use of steam, which was introduced into the shed for the purpose of enabling heavily-sized goods to be woven. At the meeting I asked for information as to whether any method was adopted for the purpose of estimating the

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amount of moisture present, and I learnt, to my astonishment, that this was not the case; that no limit was placed upon the amount of steam admitted, and that this had naturally given rise to complaints; that the moisture was frequently excessive, and that the health of the operatives suffered in consequence.

"The remedy for this was easy, and forcibly illustrated the benefits to be derived from the application of simple scientific principles to industrial affairs. I suggested that it would be perfectly possible to determine by means of hygrometers the amount of moisture present in the air of the shed, and therefore to fix a definite limit which should not be exceeded. For this purpose I drew up a table which was afterwards inserted as a schedule to the Act, and is to this day acted upon, showing how the amount of moisture must be regulated under seasonal and other changes of temperature, inasmuch as during the hot weather a larger absolute amount of moisture can be brought into the air of the weaving shed than during cold weather, without any inconvenience being experienced. These proposals were adopted by Government and became law in 1889. By these means a limit was fixed restricting the amount of moisture present in weaving sheds, this limit being controlled by the inspector and open to the observation of both masters and workpeople."

I think that is a sufficient extract to quote to show what was in the mind of Sir Henry Roscoe. I was his assistant at the time. I only played an insignificant part, and we had to look into this question, and it appeared to us that steam had been used indiscriminately—that there were valid reasons why it should be restricted. It was used excessively; it was used, as he says, without knowledge of the simple scientific principles governing its use; so we set to work to produce a schedule which would remove the excesses of moisture and produce a condition of affairs which would be more satisfactory. The value of that is proved by the results which have been obtained. Great improvement has taken place.

10. (*Chairman.*) It strikes me that what you read is very interesting, but it only tells us that Sir Henry Roscoe recognised an evil and set to work to remedy it, and he drew up tables which he says have produced good results?—Yes.

11. But he does not tell us on what he based his tables—whether it was a mere opinion that at certain temperatures a certain amount of humidity might be introduced. He does not tell us at all on what he based his opinions. Now these tables have been in use for a very considerable time, practically nineteen years, and I understand, so far as the operatives are concerned, they are not satisfied with them; they think that too much humidity is at times introduced. Now what we want to get at practically is what is really necessary for carrying on the trade. That, I think, is necessary to the weaver, who is a piece-worker, as much as it is to the manufacturer. The trade must be carried on, I take it; but what we want to arrive at is whether the trade can be carried on under conditions (whether they are healthful or whether they are otherwise) that will give reasonable comfort to the worker?—Of course, Sir Henry Roscoe, in framing that schedule, had to have regard to the conditions that are essential for the satisfactory carrying on of the process of weaving. It is a well established fact that moisture is essential to the process; and therefore he had not very much difficulty in framing that schedule to protect the rights of the manufacturer and at the same time to remove the complaint of the operatives that they were exposed to excessive moisture. Now, when you come to look at that schedule, and say to yourself, How can I improve it; this has worked for so many years; can I improve it; can I give something which would be beneficial to the operatives and at the same time not take away from the value of the process of weaving?—then you are faced at once with a difficulty. You will notice on that schedule that up to a certain temperature the difference between the wet bulb and the dry bulb is 2° . That was a great move. I have a great objection to refer to anything as a standard. A standard, in my opinion, must crystallise out of practical results. Although I use the word "standard" reservedly, I do not look upon it as a standard fixed for all time; but using it with that reservation as a standard it

will simplify matters. He took 2° as the difference. We knew then we were so many degrees above the dew point. We knew of the general complaint, and that was the complaint that satisfied Sir Henry Roscoe and Sir William Houldsworth that something ought to be done. Sir William Houldsworth was a gentleman who interviewed Sir Henry Roscoe and discussed these problems, and from whose firm we received some knowledge, and that schedule is based upon some knowledge other than that of a purely scientific chemist. When we come to discuss high temperatures you will also notice that we raised the limit between the wet bulb and the dry bulb; therefore we must have received some information from Sir William Houldsworth, who was in daily communication with us, and who, as a matter of fact, was at the conference when we set to work to produce that table. Supposing that, instead of taking the difference between the wet and the dry bulbs, we take the reading as a matter of fact in this table for the sake of removing the excess of moisture or the liability to reach saturation point—supposing we had taken 3° more—that is, instead of having the difference between the wet bulb and the dry bulb of 2° , we take a difference of 5° —we are immediately producing such a dry atmosphere that the manufacturer cannot use it; and I have prepared this afternoon, to illustrate it to you, and to make the whole thing, as it were, in a picture for you to realise, this diagram.* The top line, for instance, is the amount of moisture that is allowed under this present schedule in a cubic foot of air. This indicates in a graphic form the moisture that is allowed under the schedule. It is these figures set forth there in that picture on the top line. First of all, let me define what the operatives most object to, and what we personally would object to if we went into a mill and came out—we should say we felt chilly if we got hot in a mill where there was much moisture and came out into the open air, because there would be evaporation and condensation, producing a sensation of chilliness. That is what they most object to—it is what I call a chilly feeling. We experience that ourselves in coming from a hot, humid atmosphere into a dry one; you get condensation. In other words, the operative can be compared to the wet bulb itself when he comes out and gets a chill. What he complains of is exactly what would happen to your wet bulb when you take it out from there into a dry atmosphere.

12. (*Chairman.*) Perhaps Mr. Cross or Mr. Shackleton can tell us whether that is what they really object to. It is not the feeling of being chilled, I think, but the excessive heat in summer.

13. (*Mr. Shackleton.*) There are two features; the point that is raised in the reference is also the excessive heat in summer. What Mr. Scudder refers to is what we feel in winter.

(*Witness.*) I am dealing now with the effect of humidity. This is the principle I want you to realise, and it takes a lot of consideration. Supposing you are in a humid weaving shed with a percentage of saturation of 88 and you are in an atmosphere of 75° , and you go into an atmosphere of 60° but with a saturation of 88 per cent., you feel no effect. The moisture is solely responsible for the chilling effect produced. If you are in a weaving shed at a temperature of 80° and the saturation is 88 per cent., and you walk out into a shed at 60° and the saturation is 88 per cent., you could not tell one mill from another, or if you opened a side door and slipped into another room. I want you to follow that, because that is one of the first things I would like you to satisfy yourselves of as a comment: that if you are in a place at a high temperature with a relative humidity of 88 per cent., and you leave that chamber and go into a room where you have a saturation of 88 per cent. but a lower temperature, you do not feel any chill. Now, I have put here in this curve, in a sort of diagram, the chill you would really experience coming out at these various temperatures. I have plotted on temperatures from 52° up to a temperature of 86° , because when I come to deal with temperatures I will show you how far you must regulate the temperature, so that at these various degrees of temperature you are allowed that amount of moisture in the

* Appendix IA.

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atmosphere under that schedule. You have that chilling effect which progresses with a rise of temperature which agrees with your own sensation; that agrees practically with my own sensation on going out of a mill.

14. (*Professor Lorrain Smith.*) This has been determined by sensation?—It has been calculated, but the physiologist must tell us the effect when you see the difference between the chill at one figure and a chill at another figure. Supposing, then, you said you would have 3° less between the wet and the dry bulb—that is, 5° of difference—it would still have that chilling effect. I put it to you, could a person going into that atmosphere tell any difference, although you strengthened that schedule to the large extent of 3°, and made it so that the process of weaving could not be carried on. I am pointing to that which now represents the maximum under this schedule; and if you were to knock 3° off the wet bulb you would still only reduce it by that much, and you would have such a low humidity that the process of weaving could not be carried on.

15. (*Chairman.*) Let us be clear on that point. I am not disputing it for a moment, because probably you other gentlemen know much better than I do. It is simply a statement that the process of weaving could not be carried on, but has that been experimentally determined?—I think it has. I will put it in this way to you. As a chemist, I must say this from my knowledge of the subject: as far back as 1879 humidity or moisture in the atmosphere was recognised as essential to the process of weaving, because chemists have published results showing that if they removed the moisture from the yarn the breaking strain of the material was considerably reduced. For instance, if you have yarn with 8.9 per cent. of moisture, it was proved in 1879 by experiments that the breaking strain of the material was 64 lbs.

16. I have been to the testing office this morning, and I asked Mr. Lester if he could give us any information as to the breaking strain of yarn with different degrees of moisture. He told me that he did not think there had been any really reliable experiments upon that point. I take it that you are referring to some reliable experiments?—If I may be permitted, I will give you the original reference to Mr. William Thomson, who wrote a book on the sizing of cotton goods in 1879. I have hurriedly put here in pencil an extract from his table.* I will give you the exact reference. When the yarn had a percentage of moisture of 8.93 the breaking strain was 64 lbs. When it contained 17.39 per cent. of moisture it had a breaking strain of 69.2 lbs. Now the same yarn, when it was dried so that it only contained 2.89 per cent. of moisture, had its breaking strain lowered to 39.9 lbs.; in other words, with increased moisture you only raised the breaking strain by 5.2 lbs.

17. (*Mr. Roberts.*) May I ask at what figure you started?—At 52 practically. After 52 it goes the other way about.

18. You said that these lines were drawn up on 2° of a difference?—Yes.

19. How far do you carry it up?—Up to 86.

20. You said if you carried it up 5° of a difference between the wet bulb and the dry bulb you got to such a point that you could not weave?—Yes.

21. At what temperature do we get to the point that we cannot weave?—It is not a question of temperature, it is a point of humidity entirely.

22. Up to a certain point?—It is a question entirely of humidity.

23. At a temperature, say, of 70 and 65?—We have a humidity of 73 per cent. At 70 and 65 and a humidity of 73 per cent. I take it you are outside the zone.

24. That is the point I want to come to. At what relative humidity do you get the yarn so that it becomes unweavable?—Anything below 75.

25. Anything below 75, then it is unweavable, and keeps going worse?—Then I say there is some valid contention on the part of the manufacturer that he should interfere. There is a valid reason why a

manufacturer should interfere when it gets below 75; he is then called upon to make use of moisture.

26. At any temperature?—At any temperature below 75 per cent. relative humidity.

27. (*Professor Lorrain Smith.*) It must be 75 per cent. of moisture at any temperature?—At the temperature that he quotes.

28. (*Mr. Roberts.*) The point I wish to raise is this: that at any given temperature what is the least relative humidity with which Mr. Scudder thinks it is workable?—I think 75.

29. 75 for the whole scale; 75 is the least?—Yes.

30. (*Chairman.*) 75 per cent. of relative humidity?—Yes.

31. (*Mr. Roberts.*) We cannot do with 75 per cent.; we cannot weave at 75 per cent. successfully; we must have more?—That is why I have made that diagram, in order to put that matter clearly.

32. I say that that is the very lowest possible, 75 per cent. I mean to say at 75 per cent. you want more moisture. As Mr. Scudder said, when you get down to 75 per cent. relative humidity you are injuring your weaving. You are getting into a dry atmosphere, and you are materially suffering from it.

33. (*Professor Lorrain Smith.*) What is the idea of relative humidity?—By relative humidity I mean that on the transition from one atmosphere to another no moisture will be lost on an article if the relative humidities are the same.

34. (*Mr. Shackleton.*) You would say this: that if the manufacturer has 80 per cent. already in his shed there would be no necessity for artificial humidity?—No, I think they all admit that—at least, all those who have directed keen attention to it.

35. If a manufacturer has by natural laws 80 per cent. in his shed?—He does not want steam.

36. (*Mr. Roberts.*) I agree with that; if he got anything over 75 he would not need artificial humidity?—No.

37. He would size to meet a humidity higher than that?—Yes.

38. If he required more than 75 it would be because the sizing would be to meet a humidity of more than 75 per cent.—When you come to a question of sizing that also has some influence. There must have been something which for the moment I cannot bring my recollection back to—a reason why we should give them less humidity the higher the temperature, unless the sizing was more liquid at a higher temperature, and did not require so much moisture. There is that to be considered. That may be a reason why that came about.

39. (*Mr. Shackleton.*) Was this view not in the mind of Sir Henry Roscoe and his Committee—to discourage excessive heat?—Certainly that was the idea—to discourage heat. We all know that if we go into a mill that is over 73° Fahrenheit, there is no occasion for a mill to be over 73° except in exceptional circumstances over which you may not have any control; that is the summer temperature; there must be a qualification.

40. (*Chairman.*) Following up Mr. Shackleton, I should like to put to you perhaps very much the same sort of question. It has a great practical bearing upon the case. Assuming that there is in the atmosphere without any artificial means a certain amount of humidity—I say a certain amount, because I am going to ask you afterwards what amount—it would be unnecessary to introduce any artificial humidity for weaving purposes into the shed?—I beg your pardon; I do not quite follow that.

41. I take it that, in your opinion, it is not always necessary for manufacturing purposes to introduce artificial humidity?—No, it is not; I think that is admitted by every manufacturer.

42. When, in your opinion, does it become necessary for manufacturing purposes?—When the relative humidity of the atmosphere is lower than 75 per cent.

43. Would not you allow any margin? Would you, as a practical man, say that a manufacturer should not be allowed to introduce artificial humidity when the atmosphere without it contains 75 per cent. of humidity?—The difficulty is this: you are discussing the point purely from the question of humidity. If

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you introduced outside air into a shed it would be cold to the people; they would not like it. The idea is to give them warmth. There is the humidity in the outside atmosphere. They could not work in a mill without wanting artificial heat; then they lower the relative humidity, and then they begin to lower the strength of the material through drying. You must have both humidity introduced and heat introduced. Heat is essential. If you took away the heat you would be in great trouble. Giving the operatives heat you must have humidity with it.

44. The question is this: We assume that inside a weaving shed there is the relative percentage of humidity of 75°. Do you consider that for manufacturing purposes it is necessary to introduce any more humidity?—No, if it has got 75 it is all right; but you cannot get that by natural means.

45. You could not get it?—No.

46. You mean that the outside atmosphere would not contain it?—No.

47. (Mr. Cross.) Supposing the dew point were 60°—we are speaking of the dew point—and it caused dew at 60°—say in the early morning, if you like, in summer time, between two and three o'clock, or at any time you like—would the moisture in the air during the whole of that day be much altered?—Yes, it would very much.

48. What would it be?—Last week it was 75 per cent. of saturation, according to the newspaper, in the morning and 85 per cent. in the afternoon—10 per cent. difference.

49. Perhaps I have not put it so clearly as I ought to have done. Would it be much drier in the summer time, supposing the dew point were 60° or 70°; would there be less moisture in the air during that day?—Of course, we can refer to that at once by looking at Glaisher's tables.

50. Supposing the dew point to be 60° or 70°, would there be much alteration and less moisture during the whole of that day? We have to take into consideration the heat of the summer, and there might be a change in the wind which would lick up the moisture?—Supposing we take 70° as the dry bulb and on this schedule 68° as the wet bulb, the dew point of that is 66·5°; that is one and a half degrees below the temperature of the wet bulb, and I think you will find that runs pretty well the same down there—that the dew point is one and a half to two degrees lower than the wet bulb.

51. So there would not be much change during the whole of the day as regards less moisture?—No, there could not be.

52. Then if I keep the shed something near to that, or try to bring the conditions of a shed to dew point as regards moisture, should I have any chance of manufacturing?

53. (Mr. Roberts.) It would be raining if you were not careful.

(Witness.) You have also to consider, from the manufacturing point of view, that saturated air is very detrimental to the manufacture.

54. If we got dew point in the shed we should have it raining?—You would have condensation.

55. (Mr. Shackleton.) With regard to one point, I would like to ask Mr. Scudder one question. He made a statement that an employer could not get 75 per cent. without artificial humidity. I understood you, Mr. Scudder, to say to Mr. Roberts that in order to get 75 per cent. of humidity it was necessary to have artificial humidity in certain conditions of weather in summer time. How do you account for weaving processes going on all over the country without artificial humidity, and still getting 75 per cent. They must get it; without it they could not weave?—They could not be weaving heavily-sized material.

56. We are not talking about heavy size. It is the steaming question, or the question of humidity. It is not a heavy-sizing question now?—It is a very large question.

57. I want to get clearly from you, Mr. Scudder, how do you account for more than one-half of the mills being worked without steam, without artificial humidity of any kind, and weaving going on, if they

cannot get it without artificial methods?—They must get it by employing lower temperatures where they have got the relative humidity of 75 per cent.; in other words, I do not know a mill that is not using steam, artificial humidity, that has a moisture of less than 75 per cent.

58. I have not the papers before me now, but I think there was an inquiry made whether in dry sheds only humidity was more than 75 per cent. at various times of the year?—That was a natural condition.

59. My point is that it may be obtained by natural conditions?—There are certain days when the average humidity of the atmosphere outside is 84 per cent., taking all the year round.

60. In those sheds they have no method except natural humidity; they have not it there; but they are bound to weave.

61. (Chairman.) Of course, Mr. Shackleton, Mr. Scudder has very kindly given us evidence, and I do not want to take the words out of his mouth, but there is one point that does strike me about dry sheds, and it is a point we will have to consider later on. There may be conditions in the dry sheds and in the humid sheds which are entirely different, inasmuch as in the humid shed a certain standard of ventilation is required, and in the dry shed it is not. When you come to test them I find the proportion of C O₂ running up to perhaps 25 to 30 parts in 10,000, which would not, of course, be allowed for a moment in a humid shed. When we come to moisture, if everything were shut up and people were perspiring, you would get a great deal of moisture from respiration and perspiration. Moisture may be had at the expense of impure air. I do not say it is an explanation, but it may be an explanation.

62. (Mr. Shackleton.) The point made was rather an important one, that it could not be got without artificial methods.

(Witness.) If you will permit me I will qualify it to the extent that I had in my mind mills that are efficiently ventilated. There are other instances which the Chairman has pointed to. We know other instances where flags are put down of a porous nature which supply the moisture, and where artificial humidity is not required. We investigated several such cases. I know moisture from the ground alone may supply the humidity necessary for weaving.

63. (Chairman.) You were talking just now about the breaking strain of the yarn with different degrees of moisture. When yarn becomes very dry would electrical conditions interfere with practical work. I mean would the yarn, when it becomes dry, become more or less electrified?—No doubt it would by the friction.

64. How would that interfere from a manufacturer's point of view?—It would be very detrimental.

65. (Professor Lorrain Smith.) What does it do?—It breaks the thread.

66. No doubt, but what actual change in the yarn takes place?—None at all; no chemical change, only a physical change.

67. How does it show itself?

68. (Mr. Higson.) It ceases to be elastic; it will not yield at all; it snaps.

(Witness.) It loses its elasticity.

69. (Professor Lorrain Smith.) I have heard it suggested also that it becomes in a state in which the small fibres stand out?—That is so; all that would tend to bring about its brittleness.

70. (Mr. Roberts.) I can put before the Committee tables of actual tests that will prove everything that Mr. Scudder has said.

(Witness.) I go quietly about as a chemist in mills, and they allow me to deal with my carbonic acid tests freely, and while doing so it came home to me very forcibly by illustration that I was acting in the same way as a wet bulb thermometer. That is why I have brought before you these diagrams.

71. (Professor Lorrain Smith.) As to the question of Mr. Scudder's personal experience of bodily discomfort and working in those conditions, can you get at that?

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72. (Mr. Cross.) I work at 90° in summer.
(Witness.) It is a very disagreeable feeling at 90° Fahrenheit.

73. (Mr. Cross.) They are pouring steam into the shed all the time, and that schedule permits it. It does not say there is any limit to it.

74. (Professor Lorrain Smith.) How does that schedule deal with bodily discomfort—has it any relation to bodily discomfort?

(Witness.) I examined 25 what I may call fairly well ventilated mills for that report. There was very little discomfort when you came out; only that clammy feeling.

75. (Mr. Cross.) I submit this as a weaver. Taking midsummer, say the month of July at about half-past two in the afternoon to half-past five, it is hot outside, too. The employer goes by that schedule; he does not break the law, but keeps close to it when they are getting 88° to 90° of heat, and they are pouring in steam, and between half-past two and half-past five I do not feel any inclination to work, but I have to do it. That is our complaint.

(Witness.) It is not a question of humidity; it is a question entirely of heat.

76. (Chairman.) We might put it, Mr. Cross, to Mr. Scudder in this way: Can he, as a practical man, suggest some means of introducing during the extreme hot weather sufficient humidity for manufacturing purposes without causing excessive heat. I mean the temperature outside may be 90°—that we cannot help; but I mean, bearing in mind the natural conditions of the atmosphere, can he suggest some means of keeping down the temperature as far as it can be done without interfering with what is necessary for manufacturing purposes?

(Mr. Cross.) Exactly.

(Witness.) Of course, that is a very pertinent question. It is one I have directed some attention to, but I am sorry to say I do not know of any practical means of effectually gaining anything by the introduction of mechanical appliances. I know of no invention that will reduce the temperature 10°.

77. (Mr. Shackleton.) 10° is a lot?—I know processes that attempt to do it that are worthy of being tried, but they have to have a great deal of support and sympathy from manufacturers, and the manufacturers have to have a great deal of enterprise.

78. (Chairman.) You know there are different means of introducing humidity?—Yes.

79. There are some by what is called live steam introduced directly into the shed?—Yes.

80. There are other methods, introducing a water spray, not directly in the shed, but into a chamber, and from the chamber into a trunk, and so on, and by means of a trunk and plenum ventilation that water is distributed over the shed?—Yes.

81. I take it that would introduce sufficient artificial humidity without introducing unnecessary heat?—It is possible to do it. I am sure, as a chemist and a technical man, having investigated many of these processes, it can be done. The question is entirely one of cost, and entirely a question of the spirit in which such appliances are received.

82. (Chairman.) I should like to refer the Committee to a report that I recently wrote on mills in India. I went into a mill in Nagpore, in Central India, when it was extremely hot outside. When we got in it was quite a delightful atmosphere, and it was pleasant to be there.

(Witness.) You have there the heat of the air, which is so great that it produces evaporation, and so cold.

83. It was done by cold water. In the report will be found the meteorological condition of the mill every day for a whole year, and the condition of the outside atmosphere. It was found that from a sanitary point of view it was far better inside the mill than outside. There may be reasons why we cannot do it in this country; at the same time, it may be worthy of consideration?—I admit you can get a reduction of something like 10°, but it is a question of cost, and it is a question of whether people who are buying the apparatus will take that interest in it to carry it on.

84. (Professor Lorrain Smith.) In drawing up the schedule was any attention paid to the limits possible for human beings to stand, say, the wet bulb temperature?—I do not think that came into our mind. I am afraid my original, which is destroyed, never covered the range of the present schedule. I have an idea that I never went above 85° dry and 79° wet. People can work at that.

85. You go up beyond that?—Yes, that is an exaggeration.

86. (Mr. Cross.) I want to go back to the inquiry referred to in 1888. I well remember at that time that our people were under the impression when they got to an arrangement with regard to that schedule that steam had to be ceased to be used at 70° of heat. When this Act became operative they found there was no mention of it. It seems they must have been very much mistaken, or else I think the Home Office would have put it into the schedule. Our late President, Mr. Holmes, was always under the impression, even to his last day, that after 70° of heat no steam should be introduced into the mill. Do you remember anything of that kind being raised at that time?—No.

87. (Mr. Higson.) It was distinctly understood that no artificial heat should be used in a mill that stood at 70°.

88. (Chairman.) That is part of the Act of Parliament now.

89. (Mr. Higson.) Mr. Cross thinks there was a misunderstanding. Mr. Holmes and others thought that 70° of heat meant a cessation of steaming. —(Witness.) What was in our mind was this: we gave them some moisture. If they had not moisture they would be in a difficulty again; it would be too dry and oppressive and disagreeable, and probably more dangerous with moisture.

90. (Professor Lorrain Smith.) The point you stopped at was 85° of the dry bulb; why do you think you stopped at that?—I think after that the heat is not necessary; it is unnecessary heat that ought to be stopped.

91. Why?—Because it becomes so oppressive and disagreeable. I would not like to work in a room at 86° all the day through.

92. (Professor Lorrain Smith.) The point at which Mr. Scudder's own work on this schedule stopped was a dry bulb of 85° and a wet bulb of 79°, and I asked him on what grounds his work stopped at that as a limit.

93. (Mr. Roberts.) Would you mind repeating why you stopped?—I think beyond that stage it is so disagreeable that it ought not to be permitted, because the sensation is so disagreeable.

94. Too hot and too humid?—Not too humid; it would be too dry.

95. I mean to say if you went up in your dry you would naturally go up in your wet?—When you got to that temperature you would be wanting to drink all day through. That would be disagreeable.

96. How does it come that the schedule has run on to these very much higher temperatures?—I cannot tell you. I know from our original we never calculated for those temperatures. You cannot weave below a temperature of 60° Fahr.

97. (Mr. Shackleton.) Is not it this: you are looking at the result of Sir Henry Roscoe's inquiries many years later?—No, this percentage column was to give further knowledge to people.

98. The new one gives the grains of vapour?—The new one gives the percentage of humidity. These temperatures are no use. You can cut off up to 60° and discard the figures. I agree that above 85° I should like to see it stopped.

99. (Chairman.) You would like to see what stopped?—The temperature; you must not go beyond 85°.

100. Supposing the outside temperature were 90°?—Subject to that condition.

101. (Mr. Shackleton.) That is of rare occurrence?—That is of rare occurrence.

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102. It is not of rare occurrence to get over 85° inside a shed in the months when the holidays are on when everybody knows there is extra pressure naturally brought to bear by the weavers themselves for holiday arrangements. They work a bit harder during that period, and during those two months there is frequently, especially in the older sheds where there is not the same loftiness—there is frequently and constantly over 85°. We wanted to know from you whether you approve of the suggestion that if it can be done at 85° it may be brought down to 80°, and that there should be some method of reducing the heat?—I do not think the proprietor of a weaving shed requires such a temperature as 85°.

103. (*Mr. Roberts.*) The difficulty would be, in face of Mr. Shackleton's reason, if we get up to 85°, what are we to do?

104. (*Mr. Shackleton.*) I ask if it is possible.

(*Witness.*) It is not possible to conduct a weaving shed at over 85° in my opinion.

105. (*Chairman.*) The temperature might be 90° outside. Certainly that would be quite exceptional, but seeing that it is a possibility, if it came to a suggestion coming from us or anything in the Act of Parliament, it would have to be qualified to some extent with regard to the outside temperature.

106. (*Mr. Shackleton.*) I ask Mr. Scudder at the present time if he knows of any place where the outside atmosphere being 82°, the inside heat in the shed has been 78°—has he ever heard of such a case where, by artificial methods, the outside atmosphere being 82° the inside of the shed has been brought down to 78°?—Yes, by artificial methods certainly.

107. If it is possible there, is there any reason why any shed should exceed a proportion like that—should exceed at any time in the summer the heat of the outside atmosphere?—Not if they adopt proper apparatus for reducing the atmosphere. I presume you refer to the mills of —, where in the summer time they can spray water over bagging and put in air 10° lower. It is a question of appliances and cost, and whether the manufacturer will go to the cost.

108. (*Chairman.*) Have you any other papers to put before us, Mr. Scudder?—I do not think so.

109. (*Mr. Roberts.*) I should like to ask Mr. Scudder if he will be willing to come before us again possibly after we have thought over what he has already said.

110. (*Chairman.*) I do not know whether it suggests itself to you that any practical and methodical tests could be taken showing what is actually necessary for weaving purposes. It would be very difficult to carry out, I am afraid, because the conditions vary so much—some heavily size, some use no size, some pure size?—Quite so. Then you come to the composition of the

size used, and the use of deliquescent salts such as calcium chloride and magnesium chloride, and the situation of the shed. It is a most difficult problem.

111. The manufacturers might not give us facilities; they might say they do not want the secrets of their trade disclosed?—I do not think there is much fear of that sort of thing. I have not experienced it. I have been to fifty sheds in the course of my recent work, and I must say I was well received by them all. I was much struck by the managers of the works being anxious to learn and get some information. What struck me was that they wanted educating. If they had been educated sufficiently they would not have raised the questions they are now raising with regard to the question of moisture. I would not mind spending half-a-day with a manager who wants to be enlightened. I was between the two sides—the manufacturers and the operatives. I talked to them both. They chose their own position in the shed, and I got true results. I think on going round you will be struck, as I was, and you will find there is a desire for higher education.

112. (*Professor Lorrain Smith.*) You made a very definite limit: on what did you base it?—My own experience of going into workshops and places. At 85° it is oppressive and disagreeable.

113. How long would you be in then?—An hour.

114. You did not try any definite experiments?—I was for nine years the private assistant to Dr. Angus Smith.

115. You never did any definite experiments to ascertain the exact value of that limit that you have given us?—Not with efficient ventilation. When Dr. Angus Smith's experiments were made we warmed the room and entered and estimated the carbonic acid hour by hour.

116. Have you done any definite experiments with Dr. Angus Smith?—No, except that I think in our experiments we soon obtained results about the amount and effect of carbonic acid and the products of perspiration. Even when a shed is unventilated I do not think you should go above 85°.

117. I want the basis of that?—I can only say it is the result of my own feeling.

118. (*Mr. Shackleton.*) You mentioned the firm of Horrocks Crewdson. Which mill had you in mind?—The Preston mill.

119. On the question of cooling. A gentleman named Hart invented a humidifier?—Hart's humidifier is capable not only of giving the heat and the amount of humidity, but also some amount of cooling.

120. (*Chairman.*) I am sure the Committee is much obliged to you for your evidence, Mr. Scudder.

The witness withdrew.

Adjourned.

SECOND DAY,

Thursday, 23rd January, 1908.

At Blackburn.

PRESENT:

COMMANDER SIR HAMILTON FREER SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
Mr. H. HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor J. LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

Dr. ALFRED GREENWOOD, called and examined.

121. (*Chairman.*) I think, perhaps, Dr. Greenwood, I had better read to you the questions that we have to consider. (*Questions read.*) I think I should lay

emphasis upon this, that it is not simply a question of health, but we have also to consider the question of bodily discomfort under the conditions of the work

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carried on by the operatives. Of course, as you know, up to the present the cotton cloth factory regulations do not affect dry weaving sheds, and whereas a standard of ventilation is required in humidified sheds, there is no standard of ventilation in the non-humidified sheds. I think, having read to you those questions, it would be well if you would just express your views in your own way. First of all, I will ask you this: You are Medical Officer of Health to the County Borough of Blackburn, and have held that position since 1902?—Yes.

122. You refer the Committee, I think, to an address which was delivered in Manchester on October 26th, 1906?—Yes.

123. That was an address when you occupied the Presidential chair of the North-Western branch of the Society of Medical Officers of Health?—Yes.

124. This address was published in "Public Health" in January, 1907?—Yes.

125. I think we may take it, generally speaking, that this pamphlet may be taken as expressing your views?—Yes, with the few additional notes (they are very few) that I have prepared.

126. You say that you have not received directly from the operatives any complaints concerning excessive humidity of weaving sheds?—That is so. I did not know that the word "directly" was in there; it ought not to be there.

127. "Although such complaints would not necessarily have come to myself, I may say that I have not received any from the operatives concerning the excessive humidity of weaving sheds"?—Yes.

128. Do you think it probable that such complaints would come to you from the operatives?—I think if there had been many complaints I should certainly have heard of some of them, because I do receive complaints about many matters which really do not come under my official work as Medical Officer of Health.

129. (*Professor Smith.*) Do you lay special stress on the humidity only as you have mentioned it in this paragraph?—Yes.

130. The Chairman read out to you that it was temperature and humidity combined?—I have not received complaints regarding either.

131. (*Mr. Cross.*) You would hardly get to know of any complaint of over-humidity in any weaving shed in Blackburn from the operatives?—That is just what I was explaining, that if there had been a large number I would be sure to have heard of them. I do not say there have been no complaints at all, but that I have not received any.

132. You think it is very likely you would get to hear from the medical attendants of the workpeople?—That would be one source, and also from the operatives themselves, because although I am not in close touch with them in their actual work, I am in close touch with them at their own homes and in my work generally.

133. (*Chairman.*) In this paper that you have prepared under the heading of "Other matters," you deal with certain conditions which you assume may affect the health of the operatives, the weavers?—Yes, they may do so.

134. Of course I take it that the object you have in bringing this forward is to show that some of the complaints attributed to humidity may also be due to other causes?—They may be.

135. But you do not say they are?—No.

136. I think you should just state what you consider are the other causes affecting the health of the operatives. At present we are dealing with the weavers?—You mean in view of what I have written here?

137. In view of what you have written?—It is a fairly common custom in Blackburn for many male weavers to leave their work without putting on extra clothing at mid-day, rush through dinner and return to the mill, where they congregate in all kinds of weather near the entrance gates, smoking their after-dinner pipes; the same practice is also followed during the breakfast interval, and I have seen men sitting on the pavement. At night they are exposed to much

greater changes of temperature when leaving the mill without extra clothing. Then regularly on Saturday afternoons those same male operatives will stand either in rain or exposed to an east wind for one or two hours watching a football match. They go to football matches in very large numbers. I think Blackburn is noted for its large gates at football matches. Many of the female weavers wear a shawl tightly drawn round the head when in the open air during the week and are shod in clogs, but at the week-end they change this clothing for well-ventilated fashionable hats and thin shoes. Also at meal times I have seen operatives come out of the mills without shawls, or even coats, with bare arms, run to an adjoining shop, buy food, and return to the mill. Those are just a few.

138. Then you go on to speak of dusty atmospheres, and I think we probably all agree there, that humidity will tend to allay dust?—Yes, I mention that as a general point.

139. On the general question—and this is, of course, the important question of (to use the words of our reference) "bodily discomfort and health of the workers"—you know, of course, that there are dry sheds and there are humidified sheds?—Yes.

140. When we speak of humidified sheds there are some in which live steam, as it is called, is injected through jets directly, and in late years a very large number of different methods of humidifying have been introduced—by a water spray and other methods. We should like you, if you can, to tell us in the first instance whether you think the operatives are likely to suffer bodily inconvenience on account of humidity introduced into sheds; and, secondly, the effect that it is likely to have upon their health; and I would ask you then to say if you would be able to discriminate or to say whether, looking at the different systems of humidifying, some are likely to cause less discomfort than others, and whether some are likely to be better for the health than others. Perhaps we may take the first point—the question of bodily discomfort?—May I say, sir, before I answer that question, that I have limited the bulk of my evidence to the latter half of the second term of your reference, as to what, if any, danger to health is involved by continuous work at the degrees of heat and humidity which obtain in weaving sheds. I have prefaced my additional statement by that remark.

141. Then you refer us to the general observations concerning Blackburn weaving sheds in this. We might perhaps read the particular paragraph that you refer to?—Well, sir, perhaps it would be better if I say as simply as I can my views on this matter.

142. I think so, because we can always refer to that. If you can express your views now in concise terms, or as you think it desirable, I shall be glad?—I should like to say that I have not special knowledge by daily reading of the wet bulb and dry bulb thermometers in a weaving shed, so that I am unable to state any percentage of humidity in any weaving shed. I am unable to give you the amount of humidity in any given weaving shed, because, of course, I have not taken any readings of the wet and dry bulb thermometers officially. Frequently I have read them when I have been in weaving sheds, but from the point of view of general interest at the time.

143. You are aware, of course, that there is a table laid down by law?—I am.

144. Are you aware of that table?—I am.

145. Of course, no one can say that it is always actually observed. I take it that probably, generally, speaking, it is observed. What would be your views from a health point of view if those regulations, we will say, are strictly observed?—My own experience on that point is that sometimes, particularly in the summer months, I have felt a distinct oppression when I have been in a weaving shed. I cannot say that I have ever felt that in the winter months; but in the winter months on leaving some of the sheds I have felt distinctly chilly.

146. To what do you attribute that feeling of chilliness on leaving?—To the sudden change of temperature.

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147. Would not the question of moisture come in there rather than temperature?—I do not think so, speaking generally.

148. Assuming that the relative moisture is widely different inside from what it is outside, would not that produce a feeling of chilliness on coming out?—Yes.

149. Then I take it that you have from your own experience felt a sensation of oppression in the summer, and in the winter a feeling of chill on leaving the sheds?—I have.

150. To what would you attribute this feeling of oppression in the summer that you describe?—Possibly to a high temperature with excessive humidity.

151. With excessive humidity?—I cannot say that that is absolutely so. That is the only explanation of it that occurred to my mind.

152. (*Mr. Roberts.*) May I ask what you mean by a high temperature and excessive humidity. I will show you the table?—I remember the table; at least, I remember the most important figures of it.

153. If you have it in front of you it may assist memory at any rate?—I do not say that this is so, but from my general reading, if there was a temperature of over 70° shown by the thermometer I think it would be so.

154. (*Professor Lorrain Smith.*) That is the dry bulb?—That is the dry bulb reading, and for the sake of argument 88 or 89 per cent. of humidity.

(*Mr. Roberts.*) We are not allowed more than 88.

155. (*Professor Lorrain Smith.*) What is that in the wet bulb?—68°, and 88 per cent. of humidity.

156. If the dry bulb stood at 70° and the wet bulb at 68°, do you say under those circumstances you would consider that excessive humidity?—No, I say over that.

157. You mean if the temperature went over 70° you would begin to be oppressed?—Yes, with the same amount of moisture at a lower reading.

158. Can you give us a description of that feeling of oppression?—There were no very definite symptoms.

159. (*Chairman.*) You mentioned that you felt a feeling of discomfort?—Yes, slight discomfort. I do not lay very great stress upon it, but it was noticeable.

160. On the occasions when you felt this discomfort you did not actually read the thermometers?—No.

161. Consequently you cannot say what were the actual conditions when you felt this?—No.

162. You can only say as you have said that on going into certain sheds in hot weather you felt discomfort, and in coming out in winter you have felt discomfort, but from a different cause?—That is so.

163. But you did not actually read the thermometers, nor can you say the actual condition of things at the time?—No, that was the reason of my first remark just now.

164. (*Mr. Higson.*) Those observations would be applicable to coming out of any workshop?—Yes, in fact I have felt the same on coming out of ordinary workshops.

165. (*Chairman.*) You have spoken of bodily discomfort. Coming to the question of health, take the first condition that you describe of having gone into a humid weaving shed on a very hot day: you have stated that you have felt bodily discomfort. Assuming that this bodily discomfort continued for a reasonable time, do you think that it would affect the health of the operatives?—Yes, if it continued.

166. You cannot say for how long, because in our changeable climate hot weather may last for a long time or it may last for a short time; but supposing it continued as it would continue in an ordinary summer, how would it affect the health of the operatives?—I think it would lower the resisting power of the body generally if continued for long periods. I cannot say anything more definite than that on this point.

167. Now I refer to different methods of humidifying. May I ask if you have seen any of these different methods?—I have seen them, but I am unable to express an opinion as to which is the best.

168. When you speak of the best you are not speaking from a manufacturing point of view, but speaking from a health point of view?—Quite so.

169. You can express no opinion upon that point?—No.

170. I should like to ask you this—it is a question that of course most of us here understand, but a great many people do not understand. We will take a temperature here on this table of 90°, and you will see that at 90° 10·3 grains of moisture are allowed in a cubic foot of air?—Yes.

171. Now looking at the evidence which was given before former Committees I find that the operatives say that if at the temperature of 90° 10·3 grains of moisture is allowed, it is rather natural that the manufacturer should want to run up his temperature so as to get more moisture?—Yes.

172. But when we come to the question of relative humidity, we find that the relative humidity at 90° is only 69?—Yes.

173. We will take a temperature which I believe is considered good for weaving, we will say 70°. There only 7·1 grains of moisture are allowed, but the relative humidity is 88?—Yes.

174. We are dealing with two distinct things. We have in one case a high temperature where a large amount of vapour is allowed with a low relative humidity; in the other case we have a moderate temperature with a much less amount of vapour allowed, but with a much higher relative humidity?—Yes.

175. From a medical point of view which would affect the worker the most, the question of the amount of moisture allowed in a cubic foot of air or the relative humidity?—I think, sir, it would be far preferable to have the temperature of 70° dry bulb and 88 per cent. of humidity; in other words 7·1 grains of vapour per cubic foot of air than the other.

176. I am afraid I did not quite catch your answer?—Speaking generally, and as I must repeat, without any special knowledge of the wet and dry bulb thermometers, I should prefer to have a temperature of 70° and a percentage of humidity of 88; that is relative humidity; in other words 7·1 grains of vapour per cubic foot of air, to a dry bulb reading of 90° with a relative humidity of 69.

177. Of course we know that certain authorities have lately been giving their attention to this question. I am talking now of the wet bulb thermometer; can you express any opinion at what temperature work of an arduous nature begins injuriously to affect the system?—I could not answer that question.

178. You are not able to answer it?—No.

179. Have you had any experience in regard to the ventilation of dry sheds?—No.

180. You have had no opportunities of taking any air tests?—Not in the sheds. I have taken a large number of samples from schools for CO₂, but I have never analysed air from sheds.

181. I think this table you handed in is the relative humidity of the outside air of Blackburn?—Yes.

182. Nothing to do with the sheds?—No. I gave that table because I have been asked so frequently for the outside humidity readings of Blackburn. I should like to say that to-day the outside air is at saturation. The wet and dry bulb thermometers both read this morning 37·2°.

183. (*Mr. Shackleton.*) Is that taken from the "Blackburn Observatory"?—Yes; it is from the Corporation Park.

184. I have only one question to ask you, Doctor, that is with regard to the question of hot days. I understood you to say that the experience you have given us has been on hot days on coming outside a shed you have been uncomfortable?—On a few occasions.

185. Have you ever gone into the question of how hot a shed should be allowed to get in hot weather?—No.

186. Have you ever gone into the question of cooling these sheds in order to keep down the heat?—No. I

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have not, on the ground that I consider that those are more strictly engineering questions.

187. Have you seen the second report of the Departmental Committee signed by Dr. Haldane and another gentleman?—I have seen it.

188. Have you seen on page 6 the statement that air in which the reading by the wet bulb thermometer exceeds about 70° begins to cause serious inconvenience with ordinary clothing, and this ought not to be exceeded, in fact, in factories and workshops except under exceptional conditions?—I have seen that statement.

189. Do you agree with that statement?—I am unable to express an opinion from experience on that point.

190. (Mr. Cross.) Your observations with regard to the habits of weavers in Blackburn would apply to other operatives—card-room workers?—I did not state that these were weavers: I do not know whether the operatives belonged to the weaving or other operations.

191. The same weakness would apply to spinners and card-room workers?—To all the cotton operatives.

192. (Mr. Higson.) Have you any figures for comparison between one section of mill workers and others?—I have as regards the mortality rate. I did not draw any detailed conclusion regarding spinners and card-room hands and so on, because the figures were not in my opinion sufficiently large to draw safe conclusions from.

193. You do name it in your report and summary?—Yes.

194. (Mr. Cross.) You have not, I understand, made any special study or special observation with regard to the hot period or warm period of the year in the mill with regard to the discomfort that attaches to workpeople?—No.

195. It is only from your own personal experience as far as coming out of a mill is concerned?—That is so; and, as I said at the beginning, my evidence is mainly statistics plus a few other observations.

196. (Professor Lorrain Smith.) You know Dr. Wheatley's evidence before the Committee?—I remember that.

197. He gives a table, the death-rate of cotton operatives from 1889 to 1895 in Blackburn?—Yes.

198. Do you remember that table?—I do.

199. Does the same criticism apply that you have made about these returns?—Yes.

200. You do not think there are enough cases to base a conclusion upon?—I think any conclusion should be taken guardedly.

201. You see there is a very distinct difference here, say between weavers and spinners?—Yes, but the numbers are so vastly different between weavers and spinners.

202. Take the 1891 census; I notice that the weavers in Blackburn were over 10,000, and there were only 700 spinners?—Yes.

203. I suppose that is the reason why you criticise those figures?—Practically speaking, those figures in Dr. Wheatley's table from 1889 to 1895, regarding spinners, winders, warpers, card-room hands, tally with the figures that I have given in the three five-year periods.

204. Your criticism rather does away with the value of them?—No, not in this way: I wanted to say that in saying that there has been a marked diminution in the death rate amongst weavers I do not think the same conclusion should be put on all-fours regarding spinners, etc., on account of the big difference in numbers employed; but there has been a distinct improvement in all sections.

205. But the comparison of the weavers in the total population of the Borough is quite sound?—Yes.

206. One is 10,000, the other is 23,000?—Yes.

207. The other divisions of this table are relatively weak; I mean the basis is relatively weak?—Yes, compared with the weavers.

208. I suppose people as they grow older cease weaving sooner than in some other occupations in the mill?

209. (Mr. Higson.) As soon as they can.

(Witness.) Some of them weave a long time.

210. (Mr. Roberts.) Some of them weave till they are over seventy.

211. (Mr. Cross.) With regard to the female weaver who has left work to stay at home, on the question of comparison of the death rate amongst weavers, a weaver left a mill, we will say, a dozen years prior to her death: would she be put down as a weaver or as a housewife?—As a housewife. I think that is one of the weaknesses in the Registrar's returns; but if a weaver leaves her work on account of sickness, and is away from work, say, for twelve months, and then dies, she is classed as a weaver; on the other hand, if a weaver leaves work, gets married, and practically gives up her occupation, even although she may die one or two years later, she is classed as a housewife.

212. (Professor Lorrain Smith.) It is stated that this working in hot humid sheds makes the workers liable to such diseases as rheumatism, bronchitis and pneumonia, phthisis even (of course we have your phthisis tables here), what is your opinion—are the workers in weaving sheds liable to phthisis as compared with workers in other occupations?—No.

213. What about those other diseases which I have enumerated?—The figures show that they are not unduly liable to the other diseases, namely, bronchitis, pneumonia, asthma, pleurisy.

214. What about rheumatism?—As to rheumatism I am unable to say, owing to the fact that rheumatism itself is not a cause of death, as a rule, in the same way as phthisis and pneumonia are.

215. You cannot get direct evidence?—I am unable to say anything regarding the great prevalence of rheumatism.

216. You did not go into the sheds at all during the very hot weather we had in the summer before last?—Yes.

217. What is your personal experience then—that was an exceptionally hot period about the end of July?—That was the time to which I was referring just now when I did notice discomfort.

218. You said you noticed oppression beginning about the temperature of 70° dry bulb, but you would be a good bit beyond that at that period?—Yes.

219. (Mr. Roberts.) It went up to over 80°?—Yes.

220. From 80° to 90°?—Between 80° and 90°.

221. (Professor Lorrain Smith.) Was there any recognisable effect of that hot spell on the health of the workers?—There was not, as shown in the death returns. Whether that would have shown itself in sickness returns, I am unable to say. Sickness returns, as I have stated in this additional statement, are extremely difficult to get. If they could be got I think they would be very valuable.

222. (Mr. Roberts.) But you have nothing during that period to lead you to suppose that the hot weather, under the humidified condition of the sheds, had any detrimental effect on the health?—No; and I believe the death rate for that year, that was 1906, was very low.

223. (Mr. Shackleton.) In this table it is 16·4 per 1,000 of the living?—It is 16·4 per 1,000 of the living. It has only been lower on one previous occasion in the history of Blackburn.

224. (Professor Lorrain Smith.) What proportion of the population is there working in one form or other in the weaving sheds?—I have given the figures here. In 1901 there were 38,551 cotton mill operatives employed representing about 38 per cent. of the total population from the age of ten upwards; so that during that hot summer to which you referred there was nothing causing an increase in the death rate.

225. Have you any other occupations in Blackburn that involve working in hot humid rooms that can be compared with these weaving sheds?—I do not think so—not in the same way. The only one I

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know of in this district is a paper mill, where the atmosphere is distinctly humidified.

226. Have you any experience of that?—I have no experience of that.

227. Have you no coal mines in this neighbourhood where they get high temperatures?—No.

228. (*Chairman.*) There are paper staining works?—And paper mills at ———.

229. To which do you refer?—Ordinary paper mills where the paper is made.

230. Most of the work would be done in drying chambers in paper staining?—I referred to paper mills.

231. (*Professor Lorrain Smith.*) May we take it that you are fairly definite on this, that over 68° wet bulb oppression begins to be experienced and is progressive from that point upwards?—That is my experience, speaking generally, without a more detailed knowledge of the conditions than I have given.

232. (*Chairman.*) Would anyone like to ask anything with regard to the question of clothing, because, no doubt, if the clothing does get saturated or moist on coming out into the cold atmosphere that would be a question affecting health.

233. (*Professor Lorrain Smith.*) Dr. Greenwood, have you had any experience on that point?—I have not.

234. It is stated that the shawls and other articles of clothing hung up in the sheds get damp?—The only experience I have had of that is that on many occasions I have felt shawls and coats hanging up, and I must say I have never felt them to be unduly damp, but what the relative humidity in that shed was at that time I cannot say.

235. Still it was a satisfactory humidity for weaving purposes?—It must have been.

236. (*Mr. Roberts.*) And must of necessity have been within the Act?—Yes.

237. (*Mr. Cross.*) Would it pre-dispose anyone to rheumatism having that clothing which is not unduly damp?—I meant not unduly damp to the touch. On many occasions the clothing to the touch—which is deceptive, no doubt—did not feel any different from my own clothing.

238. In winter time in cold months, if the same moisture had to affect the clothing as in summer, would it predispose the weaver to rheumatism who was going home in that shawl or coat or vest?—I think it might.

239. It would have that tendency?—It would, especially if there were a tendency to rheumatism in any particular subject to begin with.

240. Specially so in that case?—Yes.

241. (*Chairman.*) It has been stated I see in evidence on this clothing question, that the clothing cannot get damp if the law is observed, inasmuch as unless the dew point is reached no moisture can be deposited. On the other hand, moisture is introduced for a purpose, presumably for damping the warp and the yarn; if it damps that why should not it damp the clothing?—I cannot answer that question. I can only say what my little experience on that point has been.

242. (*Professor Lorrain Smith.*) You do not know whether any observations have been made as to whether woollen garments would be more easily damped than cotton?—I believe some have been made, but I do not know of them. Wool, of course, is a better absorbent of moisture than cotton, as is generally known, I think.

243. Will it feel damp at a lower percentage of humidity than cotton?—I think it would.

244. (*Mr. Roberts.*) You do not know that?—No.

245. Not by actual experiment?—On that point one is thinking of one's own underclothing.

246. You are speaking of personal experience without any actual detailed experiments?—On that point in the mills, yes.

247. (*Chairman.*) We have asked you a considerable number of questions which you have very kindly answered. Are there any points which you would

like to bring before the Committee which bear upon the questions before us?—If I may say so, I think these mortality figures which I have got out are very interesting, together with the charts.

248. You would refer us to those?—I would. I think they are exceedingly interesting and important as showing a diminution at various age periods amongst male and female weavers from general causes, from consumption and from other respiratory diseases; and I should like to say that I can vouch for the accuracy of all those figures, because I have checked every single one myself.

249. What general conclusion do you arrive at with regard to the health of weavers—that is the question before us?—As the death rate from the various causes I have named amongst weavers, both males and females, is diminishing in such a striking degree, my general conclusion is that weaving cannot be an unhealthy occupation, and I do not see how it is possible to come to any other conclusion myself.

250. (*Mr. Shackleton.*) I should like to ask you one question on that point. I want to ask you as to your personal opinion, taking a shed humidified under the Act, and taking a dry shed where there may be, and probably is considerably more CO² per 10,000 parts, but still not a diminution to the same extent—which of those two sheds in your opinion is better? You have a dry shed so-called, but there is a certain amount of humidity in it, and the atmosphere may be more impure than in the other one—which would you prefer?

251. (*Mr. Roberts.*) May I add something to your question which might assist Dr. Greenwood, that is, in the dry shed you would have of necessity a much greater amount of dust.

(*Witness.*) I was going to mention that.

(*Mr. Shackleton.*) It depends upon the kind of work.

(*Mr. Cross.*) It would not be so much where a pure size was used.

252. (*Mr. Roberts.*) But you must have dust.

(*Witness.*) In answer to that question I should undoubtedly prefer the moist shed.

253. (*Mr. Shackleton.*) You think the question of CO² is far more important than the question of dampness?—I do not say that altogether. The point that the gentleman mentioned here would help me in giving that answer, namely, that there must be less dust in a moist shed than in a dry shed.

254. It is rather an important point which I think we might get clear upon. For illustration, we will get a table. Take 70° of heat, supposing in a dry shed they have a humidity of 65 per cent., at 70°. Take page 4 of this book. Take 70° dry and 63° wet; that is a percentage of 65?—Yes.

255. Along with that you might possibly get CO² to the extent of 15?—Fifteen parts per 10,000.

256. Against the 9, the standard of the wet shed with the corresponding wet bulb of 68° and a percentage of 88. Those are two typical cases that I want to ask you about.

(*Mr. Higson.*) Under which would you rather work?

257. (*Mr. Shackleton.*) Which are the best conditions from the point of view of health, a dry shed with 65 per cent. of humidity with 15 volumes of CO² as against a shed with 9 volumes of CO² and 88 per cent. of humidity, a standard shed against the other shed which I have given?—Putting it broadly, those are the two kinds of shed we have to deal with?—To make sure that I have got the right thing, the first case you mentioned is what?

258. 70° dry bulb, 63° wet and 65 per cent. humidity?—And 15 parts per 10,000 CO² in that one. Now give me the second case to make sure I have got it.

259. It is in large type on the table, 70° and 68°, 88 per cent. humidity with 9 parts of CO²?—I would prefer the standard, 9 parts of CO².

260. You think it better from a health point of view to have less CO² and more humidity?—Or humidity to that extent.

261. To the standard extent, I mean?—Yes.

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262. (*Professor Lorrain Smith.*) You referred to dust. Have you anything particular to say to us about that?—Any inhalation of dust in any occupation followed continuously must pave the way for or must predispose to pulmonary affections—chronic bronchitis.

263. Still, beyond the general principle, you have not noticed?—No, I have not.

264. (*Mr. Roberts.*) I should have been pleased if the doctor could have given us a little more information upon this dust question.

(*Witness.*) I cannot on the dust question.

The witness withdrew.

Dr. FREDERIC GEORGE HAWORTH, called and examined.

265. (*Chairman.*) Will you kindly give us your full name and qualifications and tell us what offices you hold?—Frederic George Haworth. I am a Bachelor of Medicine, Master of Surgery; I hold a Diploma in Public Health, Cambridge, am Medical Officer of Health to the Borough of Darwen, since 1894, and I am Medical Officer to the Education Committee.

266. I think in Darwen there are a large number of cotton factories of all sorts?—Yes.

267. Taking the weaving sheds, are they chiefly humidified?—Most of them.

268. We may take it in your experience you have had an opportunity of judging generally as to the health of the workers employed in weaving sheds?—Yes.

269. Both dry and humidified?—Principally in humidified sheds. I do not know that there are many dry ones in Darwen.

(*Mr. Roberts.*) One.

270. (*Chairman.*) Amongst other points referred to us as a Committee, we have to report upon at what degrees of heat and humidity definite bodily discomfort arises (bodily discomfort is particularly mentioned you will notice) under the conditions of the work carried on by the operatives, and what, if any, danger to health is involved by continuous working at those degrees of heat and humidity. Now, perhaps, you will tell us what conclusions you have arrived at, speaking from a health point of view, as to the effects of humidity in weaving sheds?—Bodily discomfort is a relative term rather difficult to explain, because weavers are, as it were, acclimatised to the work, and they personally feel discomfort not so soon as I should going into a weaving shed.

271. Might I interrupt you—could not that be looked at from two points of view, the weaver from being subjected to this condition of things for a long time might be in a low state of vitality, whereas you, enjoying more outdoor occupation, might be able to stand it better: could not it be looked at from two points of view?—No, I do not think it follows that a weaver would have his vitality or his resisting power lowered by the continued working in weaving sheds—not at the temperature which the Act specifies. The influence of the steam, when kept within the figures of this Act, has not to my observation proved a discomfort, and has not proved to be contrary to a good state of health; I do not know any diseases which can be directly attributed to the conditions of the weaving shed.

272. Have you ever been in any of these sheds on very hot summer days?—Yes.

273. Did you personally feel any discomfort on account of heat?—Yes, the discomfort inside of course I felt rather acutely, but I felt the discomfort outside as well at that time.

274. Taking your feelings on we will suppose a very hot summer day, where did you feel the most oppressed—in the shed or outside?—I felt more oppressed in the shed.

275. To what would you attribute that?—I attributed it more to the fact of a roof giving one the sensation of want of freedom through being in an enclosed space.

276. Are you able to recall what the atmospheric conditions were on any of those occasions—I mean in regard to relative humidity inside and outside?—I think the atmosphere, for anything I know of on certain dates, has been dryer inside the shed than it was outside.

277. That is in a humidified shed?—In a humidified shed.

278. Speaking generally with regard to the feeling of oppression, where would you be likely to feel most oppressed, in an artificially humidified atmosphere or in a natural atmosphere?—I do not think one could tell the difference.

279. That is assuming that the relative humidity is the same?—Yes, the same.

280. Assume for the sake of argument that by artificial means the relative humidity is raised, would that tend to cause bodily inconvenience?—No.

281. It would not?—No.

282. Not within limits?—Not within limits.

283. You see, we will take a temperature here of 90°; at the temperature of 90° dry bulb the grains of vapour per cubic foot of air allowed are 10.3. The relative humidity is 69. Now take a temperature, we will say here, of 70°; the grains of humidity at that temperature are 7.1, and the relative humidity is 88. Which state of things would you consider to be the healthier for the worker?—The temperature at 70°.

284. And the relative humidity?—At 88.

285. That would be more healthy as a matter of fact?—Yes.

286. Although the relative humidity is much greater than at the temperature of 90°?—Yes.

287. I am now talking of the wet bulb thermometer. At what point as indicated by the wet bulb thermometer would you begin to think that work would become oppressive—I mean active work become oppressive?—I think a great deal depends on the wet bulb in bringing about discomfort, but personally I have been in a room—

288. Excuse my interrupting you; I am afraid it is not quite clear. You say a great deal depends upon the wet bulb?—Yes.

289. That is a reading, not any particular make of thermometer?—No, a reading of the wet bulb. The higher the wet bulb the more the discomfort—85° wet bulb and 89° dry.

290. (*Professor Lorrain Smith.*) You have been in that?—Yes.

291. For how long?—For two or three hours.

292. Was it moving air?—No.

293. Still air?—Still air.

294. Had you your ordinary garments on?—Yes, except my coat.

295. (*Mr. Roberts.*) You had your coat off?—Yes.

296. (*Chairman.*) With what result?—Rather excessive perspiration.

297. (*Professor Lorrain Smith.*) Were you working?—I was moving about; I was walking.

298. (*Chairman.*) Did you take your bodily temperature when you went in and when you came out?—There was a man there, Mr. Scarisbrick, who went into the room with me for that particular purpose, and he walked about. I took his temperature before commencing operations; it was normal; and I took his temperature at the end of an hour, and it still remained normal. At the end of that time, an hour, the temperature was raised to 87.75.

299. Normal being what?—This was the temperature of the room. The normal body temperature is 98.4. The temperature of the room was raised to 87.75 wet bulb and the dry bulb was 92.50.

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300. That was after one hour?—After one hour, and the body temperature was 99° .

301. The body temperature after how long?—After an hour, and walking exercise at the rate of three to four miles an hour.

302. That is to say, you had got to the point where you were raising the temperature?—Yes.

303. (*Mr. Roberts.*) The temperature of the body was what?— 99° , and the highest point it reached was 99.2° .

304. (*Professor Lorrain Smith.*) How long did it take to go that length?—It took about two hours.

305. (*Mr. Roberts.*) And did not go any higher?—It did not.

306. (*Mr. Shackleton.*) What was the total difference in an hour's time?—The difference was between 98° and 99.2° .

307. You were walking about?—Walking about.

308. (*Chairman.*) Were they mouth thermometers?—Mouth thermometers.

309. I notice that Dr. Haldane always took rectum temperatures?—Yes.

310. Is that essential, do you think?—No, I do not. If it is a question of comparison, and you take the temperature of the mouth to begin with, it is fair to take the temperature of the mouth at the end. If you take the temperature of the rectum at the beginning, then the temperature in the rectum ought to be taken in the end.

311. To try and derive some practical result from that investigation, what practical conclusion with regard to weaving sheds do you arrive at?—The conclusion I have arrived at is that these conclusions I got under more unfavourable conditions than are contained in a weaving shed, because the air was still.

312. Was it dry air?—No, it was moist air. The air was still; there was absolutely no ventilation either natural or artificial, so that these conditions were not uncomfortable, and that being so, I should not consider they would be uncomfortable in the shed. I went into the shed on the same day, and it felt comfortable in comparison.

313. (*Mr. Higson.*) At a similar temperature?—No, at a lower temperature. I am told this approximation is not reached in the temperature; that is the wet bulb at 87.75 and dry bulb at 92 .

314. (*Chairman.*) It is held by many scientists and gentlemen who have given attention to this question that, as a matter of fact, our bodies are really wet bulb thermometers; so confining our attention now for a moment to the wet bulb, can you suggest any degree of temperature as measured by the wet bulb when work would begin to be oppressive, and by "oppressive" I mean likely to unduly raise the temperature of the body?—Unless the air is saturated with moisture and the temperature of the wet bulb raised higher than 87° , I cannot conceive that the temperature of the body would rise.

315. Above 87° you think it would rise?—I think it is possible it would rise.

316. Above 87° ?—Yes.

317. (*Mr. Roberts.*) Wet bulb?—Wet bulb.

318. (*Professor Lorrain Smith.*) Do you know Dr. Haldane's work on this subject?—Yes.

319. Your conclusions hardly agree with it?—The temperature that Dr. Haldane took was 78° of the wet bulb.

320. Have you got the paper—page 509 for example?—I was beginning at page 507.

321. There is 87° wet bulb, and in an hour and a half he had a mouth temperature of 101.2 , so it was going up steadily?—It was going up.

322. It went up to 101.2 in half an hour. You were two hours in, and only got to 99° ?— 99.2 . He took the rectum temperature.

323. No, that is the mouth; the rectum was 102.5 ?—I cannot dispute such observations as a man in Dr. Haldane's position would make; but I have made my own observations under the conditions named.

324. (*Chairman.*) We speak of artificial humidity; sometimes it is called steaming, and sometimes we talk of artificial humidity. There are different methods of introducing artificial humidity; there is the live steam process as it is called; there are various water spray processes; there are processes where it is allowed to go directly into a shed or sometimes it is distributed through trunks—a mixture of steam and water, and so on. Have you formed any opinion first of all from the point of view of personal discomfort and next from the point of view of health as to what system is the best?—Yes, I have. I have a very conclusive opinion, and from actual observations my opinion is that steam introduced at a low pressure, that is not more than 10 lbs. pressure, is the best form; steam in a state of very fine sub-division. I have made a number of observations, and I have found that the temperature of the shed is not raised by the introduction of steam at 10 lbs. pressure; but if the pressure is increased to 16 lbs., then the temperature of the shed goes up.

325. If it does go up?—It does go up one degree.

326. (*Mr. Roberts.*) That is from about 70° ?—From about 70° .

327. (*Professor Lorrain Smith.*) To what do you attribute that difference?—I think that under increased pressure and increased heat of the steam the sensible part of the heat is given off.

328. It is a question of hotter steam; the pressure has nothing to do with it?—Hotter steam.

329. It is temperature?—It is the temperature; I have spoken of it as under greater pressure.

330. (*Chairman.*) Of course, there must be pipes for the introduction of this steam; and, of course, we know that under the Cotton Cloth Act or the present Factory Act, they have to be covered over with a non-conducting material; but even when that is done do you think that they do not unduly heat the shed?—Pipes that we used were not covered, but they were very small pipes, perhaps three-quarters of an inch, so there would be some radiation from the steam.

331. Are you speaking of a weaving shed?—Of a weaving shed.

332. Not recently I take it?—It was a room in which my observations were made.

333. That state of things could not exist in a weaving shed now under the law?—I do not think there is very much heat given off by radiation from those pipes if those pipes are covered, and that was a question I put to the gentleman who was with me—why could not they all be covered? But he said it was just as necessary to heat the shed in winter as it was to cool the shed in summer.

334. (*Mr. Shackleton.*) I would like to ask you some questions with regard to one or two points you have mentioned. We find from the schedule that when the dry bulb is at 73 we get the wet bulb at 70 ?—Yes.

335. You have made some reference to Dr. Haldane. Dr. Haldane says when the wet bulb exceeds 70° then it begins to cause serious inconvenience?—Yes.

336. That is with ordinary clothing. Do you agree with that?—I did not experience any degree of discomfort at a higher temperature than the 70° .

337. Have you noticed any reference by Dr. Haldane to the difference between a dry temperature very high and a humid temperature considerably lower, where he makes a statement that the dry temperature has less effect on the inconvenience even at a very much higher temperature?—It will have; I agree with that.

338. May I follow that up by asking you whether you agree that if it is possible to keep down the heat in these places in hot months, July, August, September, by any means at all—I mean means that have not otherwise a tendency to cause ill-health, would you agree to such a proposal?—Certainly; I think that is a weak spot in the conditions of mill life—the summer heat in the sheds. The highest temperature that I have been able to ascertain has been reached in sheds was 93° .

339. (*Professor Lorrain Smith.*) Dry?—Dry. That is a very high temperature.

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340. (Mr. Shackleton.) You have seen that in a shed, have you?—I have not seen it, but I have been told that that has been reached.

341. Have you seen any records of that?—No.

342. (Mr. Roberts.) You know whether it is probable; I mean to say you have reason to believe it is so?—Yes, I have reason to believe that it has been so.

343. (Professor Lorrain Smith.) Assuming that there is a general agreement about this, that when the wet bulb gets to 87° the temperature begins to go up, that is really a danger to health, you say?—Yes.

344. But long before you get to that you have been suffering bodily discomfort and oppression?—I did not experience any discomfort.

345. You say you had none. How can you account for the fact that the people who have to work in it have complained of it so universally that I believe they have even asked for total abolition of steaming by a majority?—I cannot say why, I am sure; but in the month of September, in Darwen in 1906, the outside air as shown by the dry bulb was at 80°.

346. (Mr. Shackleton.) What was the wet bulb?—79°.

347. Outside?—Outside.

348. (Professor Lorrain Smith.) How often would that be?—That is of rare occurrence of course. I mean it lasted two days.

349. (Mr. Shackleton.) And rained all the time, I expect?—There were ten hours sunshine, but it was very wet.

350. (Chairman.) Could the Committee be supplied with the meteorological observations at Darwen?—Yes, I should be very glad that you should have them.

351. (Mr. Shackleton.) I think you might explain that you are responsible for those figures yourself, personally—they were taken under your care, I mean?—They were under Mr. Mainland's care at this time, but now they are under my care.

352. (Professor Lorrain Smith.) Are we to understand that working with a temperature at anything up to 87° wet bulb is free from discomfort in your opinion?—Up to 83° or 85°.

353. It was 87° when your temperature began to go up. At 85° you were an hour without the temperature going up, but at 87° your temperature rose to 99·2?—Yes.

354. So that 85° did not produce any effect upon you?—No.

355. Neither discomfort nor rise of temperature?—No.

356. Do you think that is a universal experience?—Well, I came to the conclusion that it would be, for this took place without ventilation. It was an absolutely still air.

357. *A fortiori*, it should be much less inconvenient where there is ventilation?—Yes, where there is ventilation.

358. (Mr. Shackleton.) I would like to ask you this question. Take an ordinary weaver, a girl minding four looms, necessarily walking about and turning the loom over and that sort of thing, you would call that muscular work, would not you?—Yes.

359. Dr. Haldane says with muscular work under the same conditions the body temperature may rise rapidly at 80°; that hardly bears out what you were saying, that you did not feel much at 85°?—No.

360. (Professor Lorrain Smith.) Have you any experience of mines, Doctor?—I have not.

361. (Mr. Shackleton.) And this, I understand, is stripped to the waist—that is the reference?—Yes.

362. With ordinary clothing it is much more serious, and that is the way the weavers are—in ordinary clothing with a shawl taken off or a jacket taken off?—Yes.

363. (Mr. Roberts.) You had your coat off?—Yes.

364. (Mr. Shackleton.) I want to bring out another point. I notice some returns have been got by the Home Office some time ago in which the difference is shown between a shed before ventilation and afterwards. I will take just a typical case. There are many of them. Take one where there were 15 volumes of CO²; that is an average of two tests. The same shed after ventilation was brought down, it is said here, to practically 7; it was 6·9. The second figure would represent the state under the Cotton Cloth Factories Act with humidity. The first figure would represent a dry shed with an amount of humidity which is got naturally in one way or another?—Yes.

365. Which of those two sheds in your opinion is the more suitable?—The latter one.

366. And even if it were kept strictly within the Act, running to the margin of 9 volumes of CO², you would still say that 9 volumes of CO² was better with humidity than 15 without?—Yes.

367. (Chairman.) With humidity and the standard of ventilation?—Yes.

368. (Mr. Shackleton.) I am speaking of a shed without ventilation, except windows and ventilators that may be open during warm weather?—Yes. Of course, I look upon the estimation of CO² merely as a standard; it represents the amount of organic impurities in the air, which must be very great I think.

369. You think the CO² is the safest test?—I think it is a perfectly safe test.

370. (Chairman.) You know of course that under the Factory Act there is a standard of ventilation for what are called cotton cloth factories?—Yes.

371. That is a humid shed. You also know, no doubt, that there is a large number of sheds in which weaving is carried on where there is no standard of ventilation at all?—Yes.

372. From the simple fact that there is no humidity.

373. (Mr. Higson.) No artificial humidity?—Yes.

374. (Chairman.) Do you know any logical reason why, looked at from a health point of view—that is a point upon which you are giving evidence—do you know why one shed should be immune from any standard of ventilation, and the other regulated?—I do not.

375. (Mr. Roberts.) Of course you are not a manufacturer?—I am not a manufacturer.

376. (Mr. Shackleton.) Can you say from any information you have obtained from other medical officers, say at Nelson, or Burnley, or Colne, whether there is any difference as to the life of the cotton operatives between those districts and Darwen, the only possible returns we can get being the mortality papers?—No; there are so many factors to be taken into consideration.

377. There is nothing to show that those three districts are worse from a mortality point of view than ourselves?—No.

378. You have nothing to show that Nelson is worse than Darwen?—No.

379. And all those are dry sheds?—They are all dry sheds.

380. (Chairman.) Have you formed any opinion with regard to the alleged suffering of the workers on account of their clothing getting damp?

381. (Mr. Higson.) At the same time it is a different class of trade.

382. (Mr. Shackleton.) I am speaking from the health point of view of the operative.

383. (Chairman.) It depends very much how the wind is. In an easterly wind they would shut up everything.

384. (Mr. Shackleton.) That is what I mean.

385. (Chairman.) I was going to ask whether you had formed an opinion with regard to the alleged suffering of the workers on account of their clothing getting damp in artificially humidified sheds?—No,

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but the clothing if it is hung up against a cold surface undoubtedly would get damp.

386. I was referring not to the clothing which is left when they go to work, but to the clothing that they wear when they are at work, because there are cloak rooms for what they take off.

(*Mr. Higson.*) In some cases.

(*Mr. Roberts.*) Not in every case.

387. (*Chairman.*) They have cloak rooms in all sheds constructed after a certain date—I mean it will come in course of time.

(*Witness.*) No.

388. We will consider the clothing they wear at present; do you think that on account of the artificial moisture that is introduced into the shed their clothing is likely to get damp and bring about chills when they leave?—No, I do not think so. In the first place the perspiration would make it damp.

389. The drier the air the more freely the perspiration would get away?—Yes, exactly.

390. And the more moist the air the more the perspiration would adhere to their clothing?—It would.

391. (*Mr. Shackleton.*) There is one point—I do not know whether it is important or not, but I might just ask you, Doctor. Giving us the stages of the test that you had yourself with regard to the heat of the body, I noticed you gave the figures 85° dry bulb and 81° wet bulb?—85° and 89°.

392. And 81 per cent.?—Yes.

393. The next you gave was 92° and 87°, which shows 4 per cent. less moisture?—Yes.

394. Supposing you retained the same relative humidity, what then? Suppose you had the higher degree of dry heat 92°, supposing the wet bulb had gone up and to have shown 88°, and had given 81 per cent., as it did in the first case, what effect would that have had upon the body? You see you lost 4 per cent. humidity in the two stages of heat?—I do not think the body temperature would have gone up.

395. (*Chairman.*) We have asked you a great many questions. There may be some point you would like

The witness withdrew.

Dr. ARTHUR HEYS, called and examined.

403. (*Chairman.*) Will you kindly give your full name and your professional qualifications?—Arthur Heys, Bachelor of Medicine, Master of Surgery of Edinburgh University.

404. Do you hold any official appointments?—Not in connection with the cotton trade at all. I have several insurance appointments; I am medical referee to a good many insurance companies, and have been for eight years Hon. Surgeon to Colne Hospital.

405. (*Mr. Higson.*) You are not Medical Officer of Health?—No.

406. (*Mr. Wilson.*) Are you not certifying surgeon?—No.

407. (*Chairman.*) You are in general practice in Colne?—Yes.

408. Have you been there long?—Thirteen years.

409. Various points have been referred to this Committee; one is at what degree of heat and humidity combined definite bodily discomfort arises under the conditions of work carried on by the operatives, and what, if any, danger to health is involved by continuous work at those degrees. Probably the next clause which would specially affect you is, what special arrangements, if any, are necessary in order to admit of proper ventilation of dry weaving sheds without prejudice to the process of manufacture. I take it that you understand that so far as weaving sheds are concerned, there are some, known as cotton cloth factories, in which a standard of ventilation is required and in which artificial humidity is introduced. There are others which are not under the Cotton Cloth Act or clauses of the Factory Act which

to bring before the Committee which may not have struck us, but which may have struck you?—The point of the method of introducing steam, I think, is rather an important one; steam under low temperature.

396. (*Professor Lorrain Smith.*) As cold as possible?—Yes, and I think certainly that if any method of cooling sheds in summer time could be adopted it is a matter that is very important.

397. (*Mr. Roberts.*) May I ask if in your experiment at any time have you had any idea of cooling a steamed shed where what we call live steam was introduced. You see many of these humidified sheds where they use live steam, and they have plenum fans. Some of course have exhaust fans, but take the plenum fans; has there been any experiment made whereby the air can be cooled as far as you know?—No, I do not know that. There was a shed I had intended to go through where they use the plenum system, but I certainly do not favourably look on the plenum system as a method of ventilating a shed.

398. Would you prefer exhaust fans?—Yes.

399. Why?—Because you are drawing out what is of course looked upon as a polluted atmosphere, and you draw that through the open ventilator. By plenum you are forcing in the air, and the air has to find an outlet more or less through the ordinary outlets or the natural outlets connected with the building. You attract the dust to the points of exit in the one case; in the other you blow the air through the large opening.

400. (*Chairman.*) Would not plenum ventilation rather have a tendency to keep down the dust that arises?—No, I do not think it will; that is my objection to the plenum system.

401. Then in the exhaust system you run the risk of short circuiting, of only partially ventilating the room.

402. (*Professor Lorrain Smith.*) The source of your supply is risky sometimes with exhaust systems?—You have to take your source of supply from dubious places. In the plenum you can select your source of supply.

used to be the Cotton Cloth Act, in which there is no artificial humidity. That state of things, where there is no artificial humidity, I believe exists in your district?—Yes.

410. Now have you from your personal experience any knowledge with regard to humid sheds?—I may say at once that practically I have not; in fact, I may say that I have never been inside a shed where steaming holds. The only evidence, if it may be so called, is in the way of patients coming into my surgery and complaining of the effects of the steaming. As I have said, so far as I am personally concerned, I have never been in a shed where there is steaming, and I believe there is only one in the town where there is steaming, and that is—'s Mill. In the rest there is no steaming at all in the sheds. My observations have been simply from the number of complaints that we get of people who come and complain of different illnesses, such as rheumatism, sciatica, and so on; they complain that working amongst the steam has brought them on. So far as the amount of humidity is concerned, I might as well say at once that I am in total ignorance of the thing.

411. Then the conclusions you arrived at are from statements of people who have come into the surgery?—Exactly.

412. Are you able to say that you get more complaints in regard to the particular diseases that you have mentioned from the one humid shed, as compared with a dry shed with an equal number of operatives?—That is my opinion: that we have more cases, more particularly of rheumatism, sciatica and bronchitis from the humid shed where the moisture is introduced than from a dry shed.

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413. You are perfectly satisfied yourself, from statistics and figures, that it is not a mere mistaken notion on the part of the operatives?—No; it is an opinion I came to a great many years ago. It got to this: that when they came I used to ask them very often, when they came in complaining of rheumatism and sciatica and that sort of thing: "Where do you work?" I got the same answer time after time: "I work at —'s." You understand I have no personal animus against any of the firm; in fact, two of the managers of the firm are patients of mine. I have no personal animus against the firm at all; in fact, the reverse if anything.

414. Do you think it possible that the mere fact of your asking this question as to whether they worked in a humid shed may have suggested the idea to them?—I do not think so.

415. Have you, in your experience as a medical man, gained any knowledge as to the effect on health of working in humid atmospheres and high temperatures?—A patient came into my place not very long ago—I think it was last week, when the cold weather was on—complaining of rheumatism. He said when he came out of the mill the clothes that he wore, the sleeves and so on, were quite wet, and as soon as he put his clothes on: "Ugh! it goes right through you." That was on putting his clothes on and going out into the cold air. To my mind his complaint was quite comprehensible. I do not know whether that was the cause, or another cause, but that might quite easily be the cause.

416. Take the dry sheds; do any of the workers make a similar complaint?—I do not think we have the same experience at all in the dry sheds. I do not think there is the same amount of rheumatism—and it is more particularly rheumatism and sciatica that I have found in connection with the steaming shed.

417. You know, of course, that in the humid shed, by Act of Parliament, a certain standard of ventilation must be maintained, and that necessitates mechanical ventilation?—Yes.

418. Coming to dry sheds. In some of them, I understand, there is not mechanical ventilation, and there is no standard of ventilation. Do you know anything about the condition of the air in those rooms as measured by the CO² test?—Practically nothing; I might as well say that at once.

419. You have no direct knowledge?—None whatever.

420. Or have you seen any tables or statistics prepared?—I have seen statistics. I have seen the report of the Medical Officer of Health of Darwen. I do not know whether I might be allowed to read one extract from it or not. I have it with me, if I may do so.

421. I think so. I do not think there is any objection to that.—To my mind it sums up the whole question a great deal more than statistics do.

422. (*Mr. Roberts.*) Who is the Medical Officer of Health?—Dr. Howarth. He says here: "We must allow something for sentiment, but when the workers have been exposed to a high humid atmosphere, leave work, and in only a partly-protected condition expose themselves to a cold air outside, it must accentuate their susceptibility to cold air, and the wonder to me is that there are not more cases of sickness, such as rheumatism, bronchitis, pneumonia, etc., than there are." That, to my mind disposes practically of the whole of the statistics which he brings into the after-part of his report.

423. He does point out that in his opinion it is a wonder that more cases do not occur?—That more cases do not occur. They do not occur; but still, why do not they occur?

424. Quite so; but they do not occur, and it is not our province to explain why they do not?—In my opinion we have a good many of these particular diseases.

425. Have you any knowledge of the condition of the air in these non-humid dry sheds?—I may say no, practically none.

426. You do not know anything about the relative proportion of humidity?—No.

427. We will say, for the sake of argument, that everything is shut up, practically hermetically sealed; there would be a considerable amount of humidity, I take it, from perspiration, respiration, and so on, in those sheds. Is that likely to be so? Of course there are places where there is ventilation, but I am assuming that these are places where there is no ventilation. Now, comparing the humid cotton cloth factory where there is a standard of ventilation with what you might expect to see where there is no ventilation, which place do you think would be more healthy to work in?—My opinion has been to some extent formed on the fact that the weavers in a humid shed tell us that they come out of the shed with the clothing wet, and weavers in a dry shed come out with their clothes dry. I cannot see how a weaver coming out into this kind of weather in wet clothes, and putting a damp or even a dry coat on top of them, can miss being more liable to the complaints I have mentioned in my letter. So far as the percentage of humidity, I do not know anything at all about it. It is quite sufficient for them to tell me that they come out with their clothes wet, and my opinion has been to some extent based on what they have told me when they have come into the surgery.

428. You think that would bring about a certain definite and specific form of illness?—I do, just as much as a man going about in a fine drizzling shower of rain without an overcoat, and then putting an overcoat on top of his wet clothes, might easily bring on bronchitis or bring on acute rheumatism or influenza.

429. Supposing instead of working in a shed where there is humidity, but where admittedly the air is purer—that is that there is not more than 9 parts in 10,000 of CO²—consider instead of working in that atmosphere a man works in an atmosphere where the percentage of CO² will be 15 to 20 parts in 10,000, what would be the effect on his health from working in that impure atmosphere?—I should think he would be very much like a man who has been to a crowded music hall, or something of that sort; he would have lassitude and headache, and a general tired feeling; he would not have the same energy at all.

430. In the case of a music hall or a church, or any other crowded place, that is a question of a few hours; but in the case of the operative it is a question of ten hours a day for five days in the week, and so many hours on Saturday. What would you expect would be the effect on his health if he worked, I will put it, in an atmosphere where there are 15 or 20 parts of carbonic acid in 10,000?—I should say in time it could bring on almost any complaint; it would render his system debilitated, below par; it would be a suitable soil for anything to grow upon from working in an atmosphere highly charged with carbonic acid gas.

431. (*Mr. Roberts.*) What do you consider would be highly charged with CO²?—Fifteen parts in 10,000 I should consider was highly charged.

432. (*Chairman.*) What sort of health, from your knowledge, have the workers in Colne?—I should say fairly good.

433. The mill-workers?—Fairly good. We are high up. We are up on the hill. The death rate is very very low. There is one thing I should like this Commission to do if it is possible: we have only one weaving shed in the town where there is steaming, and that is to go and see the operatives come out of that shed and see the operatives come out of any of the other dry sheds in the town. Just to look at them is quite sufficient.

434. Have you done that?—Scores of times.

435. (*Professor Lorrain Smith.*) Have you ever felt their clothes?—I have not, but I have seen them coming out almost every day in my life, I was going to say, and I have been struck by the difference in the appearance of the two sets of operatives. If it were possible for the Committee to be at Colne some time, say at half-past twelve, and look at the people coming out of the shed where steaming holds and from the ones where there is no steaming, I think you would find a difference.

436. (*Mr. Cross.*) Will you read that part of Dr. Haworth's report again?—"We must allow something

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for sentiment, but when the workers have been exposed to a high humid atmosphere, leave work, and in only a partly-protected condition expose themselves to a cold air outside, it must accentuate their susceptibility to cold air, and the wonder to me is that there are not more cases of sickness, such as rheumatism, bronchitis, pneumonia, etc., than there are." That is just what I say.

437. (*Mr. Cross.*) He admits there are cases of that.

438. (*Mr. Roberts.*) There are from any shed, but he also points out that they do not occur.

439. (*Mr. Cross.*) I thought he said that he did not admit there were cases.

440. (*Professor Lorrain Smith.*) There are no excessive cases; that is his whole argument.

441. (*Mr. Higson.*) What is the relative comparison between Colne, Accrington, Blackburn and Darwen, where you know over 90 per cent. are steaming sheds?—Do you mean in the way of death rate?

442. Yes.—I should say that the death rate at Colne is exceedingly low, and has been for years and years and years. I attribute that to some extent to the environment and situation of the town right on top of the hill. The result is that the sewers and drains are kept perfectly clean. There is no doubt that has a good deal to do with the state of health.

443. (*Chairman.*) Are there any meteorological records?—There are, I think. I think the Borough Surveyor keeps them.

444. How does the relative humidity compare with such a town as this—the natural humidity?—I should say it is much drier with us than it is in Blackburn.

445. (*Professor Lorrain Smith.*) Have you any reference to bear out the statement about the effect of the humidity amongst your patients?—I have not; I have never taken the trouble to write down whether they worked in a humid shed or not, but I can easily do it. I could easily find out, because we have a fairly large operative practice; it would not take very long to keep the record for the next six or twelve months.

446. Do the people who work in dry sheds not suffer from perspiration and damp clothes?—Possibly; but I do not think they suffer to the extent that a man does who is working in a steaming shed.

447. You think that makes a distinct difference to their health?—I do.

448. (*Mr. Roberts.*) Even although you are prepared to admit or to acknowledge that those sheds which are dry sheds have fully 15 volumes of CO_2 .

(*Chairman.*) I do not think you said that.

449. (*Mr. Roberts.*) Even if we were prepared to admit it, that 15 volumes of CO_2 did obtain, would you think that men working in such a condition when they come outside and are perspiring are not subject to chills, in the low state of health which continuous working would bring on?—If I were a weaver and had to choose between working where there were 15 parts of carbonic acid and working in a shed every day where there was steaming and coming out with my clothing and stockings wet, I should prefer to work where the 15 parts of carbonic acid were.

450. (*Mr. Higson.*) You are sure you have not an erroneous impression as to the condition of these people's clothes; you invariably say "wet"?

451. (*Mr. Roberts.*) Are you prepared to say they are in that state?—I am only prepared to say what they have told me when they have come into the surgery.

452. Are you prepared to say that even their shirts are wet?—I am prepared to say that men have come into the surgery and said their shirts were wet.

453. You are not prepared to say that from your own observation?—Not at all. It is only the history of the disease, which I have to take their word for.

454. If a person came in and made that statement, presumably he would have come from his own home, and not directly from the mill; and therefore you could not tell even if you had wished?—Just so, I could not have told.

455. (*Professor Lorrain Smith.*) How many people are there in Colne?—25,000.

456. You have a very low death rate?—Very low.

457. What proportion of that population would be employed in the mills?—I should say it is almost entirely an operative district. We have a few other industries, but very few.

458. How do you account for your having such a low death rate?—You see steaming does not hold with us, or very little.

459. What proportion would be represented by that one mill?

460. (*Mr. Shackleton.*) Perhaps one-fortieth, but you cannot judge very well without knowing the size of the mill.

I should like to ask you one question arising out of the question put to you by Mr. Roberts. He put 15 volumes of CO_2 as about what would be the proportion. Of course that is a case given. It is not an average. If you take the average of about 40 or 50 readings of sheds that have been on both systems, the average before ventilation, that is before coming under the Act of Parliament, was 12·6; so if you agree that you would prefer 15 volumes of CO_2 with a dry atmosphere rather than humidity, of course your argument is much strengthened if the average comes out about 13 or 12·6?—Exactly.

461. (*Mr. Higson.*) From your own personal knowledge do you know the amount of humidity there is in these so-called steaming sheds?—I do not. I have never been in a weaving shed where there is steaming, as I said at first.

462. You do not know the relative amount of humidity in those sheds?—No.

463. Or anything about the Act of Parliament?—I do not know.

464. (*Mr. Shackleton.*) I assume you know what an Act of Parliament means when it is given to you. Suppose this mill does no more than the Act of Parliament allows it, the percentage of humidity allowed ranges between certain figures. Take the ordinary temperature of 73 dry bulb. It ranges from 84 per cent. up to 88 per cent. That is about the average that it will run. It goes lower than that sometimes when it is a very hot day. It is humidity that we are speaking about. Do you think that humidity I have just given you is excessive, or is it injurious?—I am not really in a position to say. The whole of my opinion has been formed simply on the evidence, which I have had no reason to dispute, of the men who have come into the surgery and told me these different things. I am ignorant of the amount of humidity.

465. If 84 per cent. of humidity is put into a shed for the purpose of easing the weaving, for that is the real purpose, do you think that would have the effect of damping the clothing?—I should say this, that what is sufficient to damp the cloth is sufficient to damp the clothes of necessity. If sufficient humidity is put into a shed to damp the cloth, I do not see how the weavers' clothes can miss being damp.

466. (*Mr. Roberts.*) I take it that is simply a matter of opinion?—It is purely a matter of opinion.

467. You have no authority for saying that?—No authority at all.

468. You have made no experiments to give that result?—I have not.

469. You do not know that it is so?—I do not.

470. (*Mr. Cross.*) From a medical point of view, would anæmia result from, say, a very hot moist atmosphere as against a dry hot atmosphere?—That is rather a difficult question to answer. Anæmia is a disease which can be brought on through inhaling CO_2 , but Dr. Andrew Clarke used to say that the cause of anæmia was constipation, and if you cured the constipation you cured the anæmia. You can hardly say that a person working in a weaving shed who has anæmia has had the anæmia brought on by that. You must know the other conditions.

471. (*Professor Lorrain Smith.*) You would expect that in a place where they had steaming there would be a high death rate?—Yes, I should.

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472. (*Mr. Roberts.*) But if there happened to be a low death rate in a place where practically every shed was steaming, what then?—You could not naturally infer that the steaming was really the cause of the low death rate.

473. (*Mr. Roberts.*) You may say that the steaming combined with the better ventilation gave a better atmosphere.

474. (*Mr. Higson.*) I suppose you know the Government stipulation as to the amount of humidity there should be?—Yes.

475. Do you think that the Government would con-

sent to anything injurious to the health of the people?—I do not know.

476. After the very strict and prolonged investigation that was made?—As I say, the only evidence I have is simply the evidence of patients whose word I have no reason to disbelieve. My mind is perfectly open upon the question.

477. (*Mr. Shackleton.*) Do you know the death rate at all at Colne?—I think it is about 12 or 13 per 1,000.

478. That is at the present time?—That is taking one year with another.

The witness withdrew.

Mr. THOMAS WALMSLEY HEYWOOD, called; and Examined.

479. (*Chairman.*) Will you kindly tell the Committee your full name and professional qualifications?—Thomas Walmsley Heywood, Member of the Royal College of Surgeons, Licentiate of the College of Physicians, and I have a Diploma in Public Health. I am certifying surgeon for the Borough of Darwen, and Medical Officer to the Board of Education and the Post Office.

480. How long have you been certifying surgeon?—Four years.

481. May I ask you how long you have lived in Darwen?—I have lived in Darwen now for 19 years.

482. I think you have paid particular attention to the question of ventilation of cotton cloth factories?—I have.

483. When I speak of cotton cloth factories I mean weaving sheds in which artificial humidity is introduced?—Quite so.

484. You understand doubtless that there is a distinction between them and a non-humid factory?—There is a distinction between a dry and a moist mill.

485. Inasmuch as in one there is a standard of ventilation; in the other there is no legal standard?—Yes.

486. Have you had opportunities of personally visiting these humid sheds?—I go every week to practically the whole of the mills in the district.

487. Do your duties take you into the shed, or do you simply certify people in the office?—According to the instructions that I receive I am supposed to go and see whether the place where the children are working is suitable for them. I do not go every time I go into the mill, but I should say that there is not a shed in Darwen that I have not been in half a dozen times within the last four months, that is to say, I have been in every mill in the place a great many times.

488. Can you say in general terms what class of goods is manufactured in your district?—I could not tell you the different kinds of cotton cloth. When I go into the warehouse some of it seems perfectly smooth; at other times it has got patterns upon it. I really do not know anything about it.

489. Are they Jacquard looms?—Both kinds—all kinds.

490. Do you find different methods of humidifying?—Yes.

491. Could you just in general terms tell the Committee what the methods are?—I do not pretend to be a ventilating engineer, but I have seen them bringing in air—I mean to say steam being blown into it, and I have seen very fine jets of water being blown in. Those are the only two I have seen.

492. When the steam has been brought in, has it been brought in simply from jets, or has it been distributed in trunks?—I have seen it in both methods.

493. I do not think we can ask you from a manufacturer's point of view, but from a health point of view, have you any preference for the one system over the other?—None whatever.

494. You think from a health point of view whatever system is adopted that it is the same?—I should like to consider that question. From a health point of view, provided the ventilation is good, I do not see that it would make the slightest difference whether it was distributed from jets or from a trunk.

495. Of course it has been suggested—we do not say whether rightly or wrongly—that steam introduced in the form of what is called live steam tends very much to run the heat up, especially in summer?—I do not think so; I have never noticed it.

496. Have you ever taken any notice of the temperature at which steam goes into a shed?—No, but I have taken all the hygrometer readings in the shed.

497. That would be for relative humidity?—Yes.

498. You have no actual knowledge of what temperature the steam enters the shed at?—No.

499. I should like to say that our reference, as probably you know, says that we are to inquire into at what degree of heat and humidity combined definite bodily discomfort arises under the conditions of the work carried on by the operatives, and what, if any, danger to health is involved by continuous working at those degrees. So, first of all the question of bodily discomfort arises. Bodily discomfort is a thing that naturally must happen in the heat of summer. Then the question is whether, on account of or incident to bringing in this steam, the heat is unduly raised and there is more bodily discomfort than there would be under the normal condition of things?—I do not think so myself. Take, for instance, when you have been playing cricket or something of that sort, or tennis, you go and sit down and take a cup of hot tea, which is practically an analogous case, you inhale a certain amount of vapour from the tea, and you feel cooler afterwards.

500. Have you personally experienced any discomfort when you have gone into these sheds on the hottest days?—None whatever.

501. Or say in winter in going in and coming out, have you noticed any discomfort that you would not have noticed on going from an ordinary hot room into the street?—No, I always take my coat off when I go inside a mill, and put it on again when I come out. The only discomfort I find is that moisture gets on my glasses; but it does that if I go to the theatre or anywhere of that sort where there are a lot of people.

502. That would suggest that if it gets on the glasses it would get on the clothes of the workers?—It depends where they are.

503. Of course the workers would be working at the looms?—Yes, but they have cloakrooms.

504. I am talking of the clothes that they wear?—Undoubtedly it must to a certain extent.

505. It must to a certain extent get on their clothing?—It must do.

506. Supposing that their clothing does become damp, when they go out into the cold in winter would not that render them rather liable to chills?—I do not think so myself, because practice is against that

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theory. Practically they do not. One may think they do it, but in practice it is not so.

507. Then I think your answer will be that probably common sense would suggest it; but in your own experience it has not been so?—It has not been so.

508. What conclusions have you arrived at in regard to the present system of humidifying—when I say the present system I mean what is recognised by law, and when I ask you what opinions you have arrived at I mean with regard to the health of the persons concerned?—I have not found that it has done any harm whatever to the people. That was an interview I had in a newspaper twelve months ago. (*Handing in newspaper cutting.*) Since then I have had no reason whatever to change my views.

509. (*Chairman.*) I think this is rather long and I do not think it will be necessary for the shorthand writer to take it all down. We might have copies made of it for the different members, and I will read it now.

510. (*Mr. Shackleton.*) I have seen that I think. (*Cutting read.*)

511. (*Chairman.*) That, I take it, expresses your views on that question?—Yes.

512. You have doubtless read, as we have all read, that after ten years' experience of this system of steaming, the operatives themselves are strongly of opinion that it does injuriously affect their health, and it certainly does in the hot weather produce a feeling of lassitude and unfitness for work. That I understand to be practically the unanimous opinion of the workers. How are we to account for that, for I take it that steaming, from a wage point of view, is likely to increase the wages; the weaving will be more efficient with a limited amount of moisture; so it does not seem that their opinions are formed from a wage point of view; so how are we to account for this almost unanimity of opinion?—I do not think they have ever gone into the question properly myself. I have never found a single case yet where steaming has done any harm, and I can prove to you by figures which I have brought with me here that steaming takes place in paper mills in the depth of winter and in the coldest weather to a degree that is beyond all conception of what the Factory Acts allow. (*The witness exhibited a table.*) These excesses are all in red ink. Nobody has ever taken anything of this sort before. Here is the dry bulb reading at certain dates. Under the Cotton Cloth Factory Act, when the dry bulb is 82°, the wet bulb may not exceed 76°; then the relative humidity would be 74 per cent.; but in this paper mill it is 93.

513. That is a machine house?—Yes. I think this table is very valuable. It has never been done before. There are my conclusions at the bottom which perhaps you will read out.

514. The conclusions are that "the temperature of a paper machine house in the depth of winter is as high as the temperature of a humid weaving shed in the hottest part of a hot summer; that the relative humidity of the machine house exceeds the maximum limits of the Cotton Cloth Factory Act, 1889, by 2·5 to 19·75 per cent. at these high temperatures; that the wet bulb temperatures are higher than any records that I have yet heard of in humid sheds. Those paper mill temperatures are 85°, 87·5°, and 88°, and the highest temperature I have seen recorded in a humid shed is 83·5° Fah.; that the wet bulb temperatures are from 1° to 4° higher than the limits. The number of men employed in the paper mill machine house No. 1 is 29, and the number of men employed in No. 2 machine house is 28." Those are your conclusions, but I think it is hardly fair to compare a paper works with a weaving shed, because the number of people employed in the same area in a weaving shed will be very much larger?—Quite so, but these people are not under ventilation rules. This is an up-to-date house, entirely different from what it was ten years ago when I used to go there.

515. How many men will it take to look after each machine?—About 14.

516. That would cover a very large area?—Yes.

517. We have the fact that these temperatures are high, but have we any facts to show that the men

have not suffered?—I can take you to the works and show you the men; you will not find a finer lot of men in England.

518. (*Professor Lorrain Smith.*) Are they all men?—Males.

519. Are they all stripped?—They do not strip.

520. (*Mr. Roberts.*) What do they take off?—They will take their coats and waistcoats off.

521. (*Chairman.*) Are there any statistics as to their health?—No. I can get the exact sickness rate from the mill from the wage sheet, but it is practically nil.

522. (*Professor Lorrain Smith.*) The wet bulb being at 87·5, do you mean they are working at hard work?—Yes.

523. Without being stripped?—Yes.

524. (*Chairman.*) Returning for the moment to the official tables of humidity, of course, as you know, at certain high temperatures the number of grains of moisture allowable is much higher than at lower temperatures?—Yes.

525. And the relative humidity at the higher temperatures is lower?—Yes.

526. What from your point of view affects the health—is it the relative humidity or is it the actual amount of grains of moisture in a cubic foot of air?—I could not say; I should say the relative amount of humidity.

527. Do you know whether that point has ever been considered seriously?—I do not.

528. Because the tables seem to have been drawn up on the basis of relative humidity. I should like to know if that question has really been seriously considered?—Not to my knowledge.

529. Have you any experience in dry sheds?—I have only been to one in Darwen, and they gave it up because the weavers petitioned to have it made into a moist shed.

530. You cannot tell us much as to the atmospheric conditions in the dry sheds?—No, I cannot. These figures are absolutely true, and I could have brought another table, but the people only took the dry bulb temperature. These men are working in a saturated atmosphere on the 17th, as shown here, but the temperature in this other paper machine room was 110° on the dry bulb.

531. (*Professor Lorrain Smith.*) It is the wet bulb that is important?—Yes, I know.

532. According to the evidence, the 88° which you have down here ought to lead to serious effects?—Yes.

533. That is if they are doing much muscular work?—They are doing a great deal of work.

534. This is in contradiction of other observations?—I do not think that has ever been shown before.

535. I mean working in the wet bulb temperature of 88°?—Yes.

536. It has been shown to produce high temperatures?—I have heard so, but these are facts. I will take you and show you the men working this afternoon, so that they would not know that anybody was going. I am only sorry that the man only took the dry bulb temperature in this other mill, which registers 110°, so I could not put this in evidence.

537. But there is no ventilation either?—Yes, the whole place is open, being a paper mill.

538. Is there a current going?—I should say that natural air is going through the whole time.

539. That might make all the difference.

540. (*Mr. Shackleton.*) You do not know what the CO₂ is here?—No, I do not.

541. (*Chairman.*) It would be almost normal I should say?—Yes.

542. Because it is all open?—It is all open.

543. (*Mr. Cross.*) You say, Doctor, that you experienced no bodily discomfort in the hottest days of summer when you went into these mills in Darwen. May I ask what period of time was covered in one visit?—I am never in the mill above seven or eight minutes at a time, unless I am investigating an acci-

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dent. But I am not used to these high temperatures. There was a time when I was going out to the East when these temperatures would have felt cold to me.

544. Would you say you had given it a good test when you were in only seven to eight minutes when you had 75° to 90° of heat?—I think you would get compensation in this way, that you can accustom yourself to it.

545. Our people say that they cannot and do not. The weavers say so anyway. Do you think that there is a greater liability or a greater disposition to rheumatism in a person leaving a hot mill in winter-time and going out into the frosty air, when there is bound to be more moisture?—Rheumatism is not a disease of moisture; it is a micro-organic disease, and the bacteria have been cultivated.

546. You do not get it through dampness then?—Not altogether; I daresay you may be susceptible to it, but these bacteria are floating about in the air.

547. I had a boy that has not been closed in anywhere, but too much cold air on Christmas Day, according to our doctor, has given him an attack of rheumatism. I do not know whether playing out in the rain or snow or frost, and sliding, has not had an effect that way?—That is our common thought about it. I had pneumonia myself; they said it was from taking cold. I had some of my blood taken away, and the bacilli were to be seen plainly. That was in the height of summer.

548. (Mr. Shackleton.) Can you tell me what the death-rate of Darwen is now?—I know it is very very low. I cannot tell you the exact figure for the moment.

549. (Mr. Cross.) Do the medical men of Darwen supply you with any statistics with regard to the ailments of patients. You say in your newspaper report there that you never found it had done any harm whatever to the people. How would you arrive at that conclusion?—The only way we could arrive at that was in discussing it in a friendly sort of way, and some one suggested something about better materials. We said we had nothing whatever to do with that; would they go into the matter thoroughly—did anybody know where it had done any harm? They said, No, nobody could give us any single instance where any harm was the result. That was my only reason. A dozen or more being together, we talked things over in a friendly sort of way.

550. (Mr. Shackleton.) You also said that some set of weavers had petitioned to have their shed turned into a wet shed again?—Yes.

551. Is that in Darwen?—Yes.

552. How long ago is that?—About 12 months. I can give you the name. It is ———. It is a new mill.

553. (Mr. Shackleton.) That is not fully up.

554. (Mr. Roberts.) They did petition, in the sense that they struck work.

(Mr. Cross.) I understand from Mr. Shackleton that that shed was not in full work.

(Mr. Shackleton.) The place has been starved; that is what has been happening. They have not got the place warmed yet.

(Mr. Roberts.) They want steam to-day and will not do without it.

(Mr. Shackleton.) With regard to discomfort: you said there was no discomfort in coming out with wet clothes—damp clothes—coming into a cold atmosphere of 33°.

555. (Mr. Roberts.) Did you say they were damp clothes?—I said there must be a certain amount of dampness; I say there is for any one of us.

556. (Chairman.) The doctor said that the discomfort he personally suffered was that his spectacles got damp. If his spectacles got damp probably his clothes got damp.

(Witness.) Let me make this addition. As soon as my spectacles get warmed, and as soon as your clothes get warmed up to the temperature of that place they do not attract moisture then.

557. (Mr. Shackleton.) If you were in that shed ten hours a day, and you came out after, say, a day like to-day, with the gas light on at 4 or half-past 4

o'clock and the heat running up pretty high, and you came out into 30° with your clothing damp to the extent you agree yourself, you say there is no discomfort at all?—Of course it is a discomfort if you or I were to leave this room and go into a cold place, and did not put any extra clothing on.

558. They do put extra clothing on?—Very few of them.

559. They put a coat on and a muffler round their necks?—Yes.

560. Many of the elder men put on a top coat as well?—Yes, the older men. What I mean by discomfort is bodily discomfort to the extent that they would come and say that it did not suit them. Whenever I go to them, I say, What do you think is the matter with you—do you think you have caught cold or something of that sort? They say, No. To my mind, in the majority of these places that I have been into there is moisture, and a lot of these cases are due to defective construction.

561. Defective construction in the mills?—In the mills. Some mills are very moist. I do not put that down to the artificial means. I put it down to structural conditions. There is one most shockingly constructed mill.

562. With regard to weavers in summer time working in an atmosphere over 80° with the schedule as it is now, working, say, over 70° or 75° or 78° wet bulb, do you think that is no disadvantage at all?—You mean the wet bulb at what?

563. You can take 85° of heat; we reach that occasionally?—I have got to 91° in one mill.

564. Take 91°. At 83·5° would there be any discomfort?—I asked that. I went round a shed, and I said, Can you tell me of anybody who is off his work?

565. I asked you if there was any discomfort in the heat. I did not ask you about being off work?—There is discomfort to any of us, but I do not think it is sufficient bodily discomfort to do any bodily injury.

566. Do you think it is anything that ought to be altered if it can be altered—if you can have a lower temperature and less humidity, do you think that a good idea?—I do not think the humidity does any harm. I think it would be better to have more humidity than more CO₂.

567. You would not agree then that if the wet bulb gets to 70° and all degrees over that it is increasingly inconvenient to the weaver?—I do not think so.

568. Dr. Haldane says that air in which the reading of the wet bulb thermometer exceeds 70° begins to cause serious inconvenience with ordinary clothes?—Is he a practical man? You must excuse me. I do not know anything about this gentleman. Is he a practical man from a medical standpoint?

569. I think so.—Is he a medical man?

570. (Mr. Shackleton.) He has settled some of the matters connected with this question.

571. (Chairman.) Mr. Shackleton, I suggest that the witness be told who he is. Dr. Haldane is a Doctor of Medicine, a Fellow of the Royal Society, and Reader in Physiology at Oxford. He has made two valuable reports on ventilation to the Home Office, and has studied ventilation above and under ground in all parts of Great Britain and on the Continent.

(Witness.) Lots of men make statements. This is only his view about it. I have never heard of this view before.

572. (Mr. Shackleton.) We can take it that Dr. Haldane is reckoned as an authority.

(Witness.) I mean to say my experience has not altogether coincided with that.

573. (Mr. Shackleton.) He says, speaking about 70° "This limit ought not to be exceeded in factories or workshops except under exceptional conditions"?—According to that all these readings nearly must be wrong. They must be all suffering bodily discomfort at everything over 70°.

574. I want to get from you whether you agree with that?—No, I do not.

575. Then it would not be any improvement to these mills from the point of view of the weaver or from a health point of view if, instead of having

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85° dry bulb, you had 78° and a correspondingly lessened degree in humidity; it would not be an advantage to the weaver?—I do not think so.

576. You would not admit then that there is any difference between the atmosphere of South America, which is dry, and the atmosphere of Lancashire, which is humid under ordinary conditions; you would say you could stand 103° here as you could stand 103° in the Southern States of America?—It depends on whether you have been living in it. I have never been here when the heat has been 103°. I have been in South America.

577. If you were working under Lancashire conditions and you were transferred into an atmosphere at 103° in South America, what do you say?—103° is different from 83°.

578. We have authorities who say that 103° in a dry atmosphere is not so oppressive as 87° here with our humid atmosphere?—It is a very difficult thing to say.

579. It is a question whether you agree with Dr. Haldane in his reference?—I should have been very glad if I had known of this to have read his paper through.

580. (Chairman.) Do you happen to have read the report of Dr. Boobyer on the ventilation of lace factories?—No, I have not.

581. There is a great deal about very high temperatures in stentering, but it is a very dry atmosphere, and he shows that workers can work at very high temperatures in dry atmospheres.

(Mr. Roberts.) Over 100°.

582. (Chairman.) Have you considered the difference between what a man can stand in a dry atmosphere and in a wet atmosphere?—I know there is a great deal of difference, but there is a great deal of difference in the pureness of the atmosphere in South America and the atmosphere of Lancashire. In one you get a great deal more organic matter than you do in the other.

583. (Mr. Shackleton.) We are talking about the effect on men who are doing muscular work. Do you say that a man doing muscular work can work quite as comfortably in a humid atmosphere as in a dry one at the same temperature?—No, I could not possibly do that.

584. There is an advantage then in bringing this down to as low a point as possible from the point of view of exertion?—When you get up to these high temperatures certainly.

585. (Mr. Roberts.) I do not think that is exactly clear. I think that Dr. Heywood has not quite understood the latter part of Mr. Shackleton's remarks. He has tried to get something from Dr. Heywood, and I do not think has put his question clearly. He begins with arguing the point as to 70° wet bulb. Now what Mr. Shackleton wished to get at, I think, is not altogether based on the position of the wet bulb reading, but rather on this point: that at 90° dry bulb we are allowed to be at 83° wet bulb.

(Witness.) Exactly.

586. (Mr. Roberts.) Now at 70° dry bulb we are allowed to be at 68° wet bulb?—Yes.

587. Which in your opinion is the healthiest or the most conducive to comfort in working? That is your point, Mr. Shackleton, I think?

588. (Mr. Shackleton.) Put it that way and see what the answer is.

(Witness.) Do you say 90° in one case?

589. 90° and 83° in one case and 70° and 68° in the other?—Of course there would be a less percentage of relative humidity at the higher degree.

590. Which in your opinion is the more comfortable to work in, which gives the least discomfort to the operative?—I should say where you get a less amount of humidity myself, at 90°, because the higher the temperature is the more moisture it can absorb.

591. Say the relative humidity is only 69?—But at the same time it would be better to work in a temperature of 90° where the wet bulb is 83° than it

would be in a temperature where the dry bulb is 70° and the wet bulb is 68°. There you get a humidity of 88.

592. (Mr. Roberts.) Is that what you understood before?

593. (Mr. Cross.) No, it is not.

594. (Mr. Shackleton.) I am quite satisfied with the answer.

595. (Chairman.) Is not it almost the same question I put some time ago only I put it with grains of moisture instead of relative humidity?

596. (Mr. Shackleton.) My point is that relative humidity is not everything in a hot place.

597. (Chairman.) I put the same question, only instead of talking of the relative humidity I talked of grains of moisture; and I understood when it was a question of the number of grains that it had not been seriously considered.

598. (Mr. Roberts.) I think Dr. Heywood said something about the height of children in that paper that our Chairman read, and said that he could prove that children, when they went to work in mills, improved in health.

599. (Mr. Shackleton.) Half-timers, I understood.

600. (Mr. Roberts.) I should like to have that point elucidated. Are there any half-timers employed in weaving sheds?

601. (Mr. Shackleton.) About 1,100.

602. What is the actual number just now?—886. I sent in my report only last week. It was in the "Darwen News." (Diagram produced.) You see here are all the heights from 38 inches up to 60. These are the boys and the girls are on this other side. This shows what they ought to be when they come to the mill. When I say "ought to be" this was an average which was given by the Secondary Education Committee of the children throughout England. This is the height that we reached in Darwen, 53.34. Then between 13 and 14 this shows the height they ought to be and what they get up to. This shows that they are very much below the average in Darwen. Now I have found that which I cannot show on this diagram, because you would want separate diagrams for everything, but I have found that where children come to the mills from very poor homes they improve much more rapidly than the children do who have been brought up in fairly decent homes; in other words, that when they get into the much purer atmosphere of a mill they improve far more than they do in their own homes or schools; and my opinion is that the factories are a great deal healthier than the schools are. Out of my rejections last year of the children I had no less than 38 cases of vermin in the head, 12 in one week. They come direct from school and they had been allowed to associate with all the other school children.

603. (Mr. Shackleton.) Put it in another way. Do the children get as much fresh air when they have to go to the mills? It is not a question of what is in the home.

(Witness.) If I had my own way, if they had not to go to either one or the other, I would rather they went to the mill than to the school, but that is a very different matter altogether.

604. (Mr. Cross.) Would not that indicate that the children vary so much from the children of all England that the effect of the early age at which they went to work twenty or thirty years ago has had an effect on the whole of the population, so that there is two or three inches of difference between the stature of the whole of England boy and the Lancashire boy?—Do not you think, Mr. Cross, that that has not to do with the factories, but that it is due to the habits of the people?

605. The same thing applies to other crowded centres. Of course, you have crowded centres in other parts of the country besides Lancashire, and the habits of the people are more irregular and worse in some centres than they are in Lancashire?—But these people are not worse here than they are at other crowded centres at all. I daresay if we were to take Oldham or Rochdale, or any place where there are a lot of operatives, they would all be of a low stature;

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but what I wanted to prove from that was this: that the children improve on going to the mills; they are in better conditions.

606. (*Mr. Cross.*) We have been under different ideas, that with the youngsters having to come to work so early it has been the cause of the stunted growth of the Lancashire population?—I must honestly say I do not agree with you there, because if you have ever grown any plants or anything with moisture they always improve.

607. We have more natural moisture in the County Palatine than they have in other counties?—That is the reason why the cotton mills were built here.

608. Still, that would really go to show that we ought to have grown a better race compared with some other parts of England?—Well, I have given you my opinion.

609. (*Mr. Shackleton.*) I am afraid your opinion is different from what we have had to listen to from the Education Department.

The witness withdrew.

Adjourned.

THIRD DAY,

Friday, 24th January, 1908.

At Manchester.

PRESENT :

SIR HAMILTON FREER SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
Mr. H. HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor J. LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

Mr. WILLIAM WILLIAMS, called; and Examined.

610. (*Chairman.*) Will you please tell the Committee your full name?—William Williams.

611. You are one of H.M. Inspectors of Factories at the present time?—Yes, in the North of Ireland District.

612. You were secretary to what is known as the Roscoe Committee?—Yes, on cotton cloth factories.

613. I think for many years afterwards you were the Inspector specially appointed for the administration of the Cotton Cloth Acts throughout the United Kingdom?—That is so.

614. You are, of course, very familiar with the tables of humidity which are now in the Factory Act?—That is so.

615. Those tables, I understand, were made on the suggestion of the Roscoe Committee?—No, they were in existence before the Committee sat. I believe originally they were drawn up with the help of Sir Henry Roscoe. They were drawn up originally for the 1889 Act, which was the first Cotton Cloth Factories Act, and, of course, they received attention at the hands of the Roscoe Committee, who, however, did not recommend any alterations in the tables.

616. Then the Roscoe Committee recommended no alteration?—No, they did not.

617. Are you able to say by whom the tables were originally compiled?—No, not positively; but I have always understood that Sir Henry Roscoe assisted in a very large measure in their compilation. The tables were discussed by the representatives of both employers and operatives, and finally agreed upon as the schedule to the 1889 Act.

618. Can you tell the Committee what was running in the mind of the compilers; on what principles they drew up those tables; for instance, were there any experiments with regard to what moisture was necessary at the different temperatures for weaving purposes, or what were the effects on health or otherwise?—Certainly there were some readings before

them. I believe before the schedule was finally agreed upon—I am speaking now from memory, and simply from what I heard at the time—that the late Mr. William Taylor, of Blackburn, took a number of hygrometer readings in his shed. To some extent those observations guided his action, and he was one of the leading people on the employers' side. I have not the slightest doubt his observations had influence in the matter, but to what extent I do not know. I may say that this discussion as to the table must have taken place before the 1889 Act was passed, and I myself was not concerned with the administration of the Cotton Cloth Act till 1892, three years after; so anything I know of that is simply from hearsay, and it may be wrong, of course.

619. From your knowledge as secretary to what is known as Roscoe's Committee, you are not able definitely to say what guided the framers of that schedule?—No.

620. You have had how many years' experience in the working of those tables?—From 1892 until 1906, roughly, 14 years.

621. And what is your opinion as to these tables—perhaps I should explain myself. It must be looked at from various points of view; first of all, the necessities of manufacture; then there is the question of the comfort of the workers, and the health of the workers; from those points of view, what is your opinion with regard to the working?—First of all, from the point of view of the manufacturer, I think there is a pretty general consensus of opinion among the manufacturers that it is quite practicable to work under the tables as they are now. Once or twice managers have told me that at the high temperatures they wanted to keep fairly close to the maximum limits, but that was exceptional. Speaking generally, as I say, the general feeling, as far as my observations went, was that the present limits are ample for the process. From the physiological point of view, the effect on the health of the workers, I am afraid I cannot give a very definite opinion. My own obser-

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vations on myself were to the effect that, roughly, up to 70° in a well-ventilated shed, at any rate, I found no inconvenience from the maximum limits of moisture.

622. (*Professor Lorrain Smith.*) Is that the wet bulb?—I am speaking of temperatures not exceeding 70°.

623. Wet bulb?—Dry bulb, even if the maximum limits of moisture were reached or approached; that is to say, supposing at a temperature of 70° the wet bulb was 68°, I felt no inconvenience; but after 70° I was not so sure; and certainly after 75° I am tolerably certain that it did feel oppressive; and I used to think in going into a shed at 80° or upwards, when the limits of moisture were approached, that the workers looked fatigued.

624. (*Chairman.*) And of course your duties took you into many sheds on many days in the week for many years?—Yes.

625. Both in summer and winter?—Yes.

626. What personal convictions did you arrive at in regard, say, to heat in summer?—The heat in summer, of course, in all sheds, even in sheds without artificial moisture, is high. The construction of the shed is such that the natural effect is to get a high temperature when the sun's rays are strong. I do not think that is avoidable; and, of course, the oppressive effect of the humidity is accentuated in hot weather. I do not think there can be any doubt about that.

627. Did it produce any feeling of oppression or discomfort to you as you went through the sheds?—Yes, distinct oppression with high temperatures. For instance, I once or twice tested myself in sheds near spinning rooms. Unfortunately I have not my actual figures here. But take a shed over 80°, say between 80° and 85°, and artificially moistened, I might have felt that oppressive, but, on going at once into a spinning room where the temperature was even higher, the feeling of oppression disappeared.

628. Perhaps it should be stated that the atmosphere of a spinning room is a dry atmosphere?—A very dry atmosphere.

629. The other is a moist atmosphere?—Comparatively moist.

630. That is why you are making this comparison?—Yes. The apparent effect on myself was frequently, though I actually entered a warmer atmosphere—as though I went into a cooler one.

631. (*Mr. Roberts.*) I suppose when speaking of these temperatures in the shed we are to presume that the humidity was according to the table?—Approaching it. As a matter of practice the bulk of the sheds in Lancashire used to keep well within the table.

632. When you speak of 85° dry bulb we are to presume, roughly speaking, that the other would be 78°?—Not more than that.

633. 79° is the limit?—Yes, but very commonly, the maximum limits of moisture were not reached.

634. (*Chairman.*) As to winter. What were your personal feelings with regard to going into moist weaving sheds and then coming out in winter—what effect did it produce?—Personally I think I am fairly healthy, and not very susceptible to changes of temperature. Of course, there was a very great change in the temperature, but as a matter of fact I never myself felt any great inconvenience from it. As a rule I had an overcoat; and I put that on when I came out, and rarely caught a cold, although I was constantly going out frequently into air that was very little above freezing point from a temperature of 70° to 90°.

635. You probably have read the last report of the Chief Inspector, in which there are certain extracts from the report of Mr. Rogers?—Yes, I have.

636. You have seen it stated that there is a very strong impression among the weavers that they suffer in health on account of the moisture?—Yes, I have seen that.

637. I think it was stated that there had been a ballot taken?—Yes, I saw that.

638. Of course we do not know the details as to the ballot, or how it was arrived at, but that is stated?—

There is no doubt a very strong feeling among many of the operatives against steaming.

639. To what do you attribute that from your own experience from the conversations you have had with the operatives, and so on?—Complaints as regards moisture were nearly always found (when I was Inspector, at any rate) to arise in summer. We rarely had complaints of excessive moisture in winter; and I suspect it was the feeling of oppression due to the high temperature, coupled with artificial humidity, which really gave rise to the complaints. Of course, that is a mere surmise on my part.

640. It has been suggested that affections, such as bronchial complaints and rheumatism and illnesses of that sort, generally attributed to chills and so on, may be traced to some extent to moist clothing; have you formed any opinion upon that question, or were you able, in going through the mills, to feel the clothing of the workers or to satisfy yourself as to whether the clothing was actually moist?—The clothing inside the mill could not have been moist in the ordinary sense of the word, that is to say, inside the shed, unless the clothes were hung up on a very cold wall or a pillar which was used as a down pipe. Speaking generally, there could not have been an actual deposit of moisture on the clothes. What might have happened, and I daresay did happen at times in the case of a woollen garment, was that the garment itself was impregnated with the air of the room, and then, on going out into the open air at a considerably lower temperature, there would be a deposit of moisture on the garment.

641. I perfectly follow what you say, that, unless the dew point is reached, theoretically no moisture will be deposited on the clothing; but I have seen it stated in evidence, and on questions of this sort put in papers I have read that if the moisture is sufficient to moisten the yarn it would also moisten the clothing; is there any way of accounting for that?—Yes, there would be. Frequently deliquescent materials which attract moisture are put in the size, and they might attract moisture from the air; but, speaking generally, my opinion is that in passing a warp through a weaving shed, little or no moisture is added. In point of fact, the object of atmospheric moisture is not really to moisten the yarn, though that is the object attributed, but it is really to prevent any undue drying. The thing has been tested. It is, of course, very difficult to arrive at an exact test, because there is loss through dust and general waste while weaving the warp, but tests convinced me that moisture is not added to the yarn as a rule in weaving.

642. You have seen practically every known method of humidifying?—I think I saw most of them.

643. There are some methods where live steam is introduced?—That is common.

644. And there are various methods by water sprays, and a mixture of steam and water, and so on. Have you formed any opinion, as far as the health and comfort of the workers is concerned, as to what is the best method of humidifying?—From the point of view of the health and comfort of the hands, apart from the question of temperature, I do not think it really matters to the workers what system of artificial moisture is used. The question of temperature may be affected; and if any one system unduly increases the temperature above, say, 70° to 75°, then that system is defective to that extent. But from the point of view of the actual moisture, assuming the source of moisture to be the same in both cases—I mean as to the purity of the steam—I do not think it matters to the worker, from the health point of view, whether it is got by steam or by the evaporation of water in the shed, apart, as I say, from the question of temperature.

645. Take the question of steam first: would the question of temperature be affected by the pressure at which the steam was admitted to the shed?—It would be very little indeed, except in so far as the pipe covering was defective. The higher the pressure of the steam that is admitted the higher the temperature at once; but the actual steam that is blown out loses heat in expanding through the air. In coming down to atmospheric pressure you practically give up your excessive temperature. There may be a

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distinct loss of heat, an extra loss of heat due to the higher pressure of steam from the pipes if not well covered, and even if well covered there might be a little.

646. Take the pipes to be well covered, steam at a low pressure would come into the shed at a lower temperature than steam at a high pressure?—Yes, but the ultimate effect on the temperature of the air is, in my opinion, exceedingly small.

647. Have you ever tested the temperature of steam as it entered a shed?—It is difficult to do so, because a steam jet at once induces a current of air. I have often put my hand over a steam jet a little distance from the pipe, and it has never been hot enough to hurt my hand. That bears out theoretical considerations.

648. Take a very hot summer, can you assume that the temperature in the sheds might be reduced by any method of using cold water for humidifying purposes?—Yes, by evaporating water within the sheds, and thus extracting the heat of evaporation from the air of the shed.

649. Or by passing air through matting covered with cold water, or any system of that sort?—Yes.

650. Or by, we will say, the "Vortex" system?—That is a system of internal evaporation.

651. Without going too much into detail, it could be done on those principles?—Yes, speaking from memory, the evaporation of one grain of moisture per cubic foot of air will absorb enough heat to reduce the temperature of the air by about 7° Fahrenheit.

652. (Mr. Higson.) For every grain of moisture?—For every grain of moisture that you put in. That is as near as I can remember the result of my calculation.

653. (Chairman.) Your duties take you, of course, into what are known as dry sheds?—Yes, only very much less frequently, of course; it was only during the last year, in fact, that I had any very great experience of dry sheds.

654. Do you know the dry sheds in the Colne and Nelson district?—I have been in a few of them. I have no intimate knowledge of them at all.

655. You know, of course, that there is no standard of ventilation in those sheds?—That is so.

656. Have you any knowledge as to the state of the atmosphere in those sheds as measured by the CO₂ test?—I have no personal knowledge.

657. Have you any knowledge with regard to the amount of moisture that is likely to be found in those sheds?—No, I do not think I made many hygrometer observations.

658. I think we need not ask you any further questions with regard to those dry sheds?—No, I am afraid I know very little about them.

659. At present you are Inspector in charge of the North of Ireland, I think?—Yes.

660. The principal industry there is wet flax spinning?—Yes.

661. What is the approximate temperature of the flax spinning rooms?—Flax spinning rooms very commonly are over 80°. They are not always so, of course, but they are very commonly over 80°.

662. And what is the legal limit between the wet and the dry bulb?—They only need keep a difference of 2° between the wet and the dry bulbs.

663. I think some privilege is granted where it does not approach within 4°?—Yes, on your recommendation, regulations were drawn up, and that is one of the provisions.

664. That they need not keep records when they do not approach within 4°?—That is so, they are excused from the necessity of keeping records of humidity.

665. What is the relative humidity in those wet spinning mills?—It varies very much, of course, but frequently it reaches 80 and 85 per cent., certainly up to 80 per cent. I meant to have got out figures for you, but unfortunately I have been so pressed this week that I have not been able to do it. With a temperature of 80° it is not uncommon to find a reading

of 75° to 77° for the wet bulb, which I think corresponds to about 80 per cent. of moisture.

666. The workers in these wet spinning rooms have a considerable amount of moisture thrown upon them by the revolving spindles?—In many cases that is so.

667. They are protected to some extent?—By splash-guards or waterproof clothing.

668. They, as a rule, work on wet floors without shoes, I think?—That is so.

669. Can you say whether there are any statistics available showing the physiological effects of working in those places?—I am afraid there are not. I have tried to get them. So far, at any rate, I have not been able to get at figures upon the point.

670. Could you suggest to the Committee the names of any medical or other witnesses who have given any attention to this question?—Professor Lindsay and Dr. Hall certainly have given some attention to it. They collected figures on trade sicknesses for the purposes of a Parliamentary Committee, but whether those figures would help or not I am not sure. The medical officer of health certainly has no figures available; I have asked him.

671. You know the terms of our reference, I think?—Yes, I have them here.

672. No doubt some other gentlemen on the Committee would like to ask you questions; probably all may wish to do so, but before that are there any practical suggestions that you would like to make, having read the terms of reference?—I think, in my minutes of evidence, I have mentioned, as regards the third subject of reference to you, the cooling of sheds in summer. First of all, there is one point I used to feel very keenly about, that is as regards the question of temperature with gas in winter. High temperature in weaving sheds is not altogether confined to the summer. Frequently, for instance, on a dull day like this, gas or artificial light is necessary in weaving sheds for a considerable portion of the day, and towards the end of the day, if the shed is lighted by gas, the atmosphere used to get very hot, and frequently very foul. I unfortunately have not taken many samples of air under those conditions, but once, I know, I got to nearly 50 volumes of carbonic acid in 10,000.

673. (Mr. Roberts.) At what height did you take those?—At the breathing height. I do not think now the results would generally be so bad, because many firms have altogether got rid of the evil by using electricity, which is, from the health point of view, a very great gain; and, in other cases, the amount of gas consumed has been much reduced by the use of incandescent mantles. That is the main point as regards the winter. As regards summer, I mentioned that the following means had been adopted or might be adopted: humidification by means of water instead of steam. That is what we were referring to just now—internal evaporation.

674. Will you kindly repeat that?—As regards cooling sheds in summer, I mention the following means: (1) humidification by means of water instead of by steam, (2) copious ventilation, (3) the whitewashing of the outside of the roofs. This should be kept up efficiently throughout the summer, (4) reduction in surface of any steam piping used.

675. Of the bare pipe you refer to?—Or, even if covered; of the pipe itself to start with.

676. What is the present standard?—Practically there is no standard; it must be as small as is reasonably practicable. For instance, I have found myself cases of pipes of 2 inches diameter being used, and I have found the whole of the winter arrangements in one case used in the summer. That should be stopped. I think.

677. I agree with that.—That is as to reduction in the surface of the steam piping. Then, of course, the steam piping, so far as it is used in summer at all, should be thoroughly covered with non-conducting material, every inch of it.

678. (Mr. Higson.) That is humidifying pipes?—Yes.

679. (Chairman.) There are others, the radiators as well, besides those steam pipes?—Yes, there is a heating range in every shed.

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680. Those would be turned off naturally when not wanted?—Yes, quite so. The final point I mention is the avoidance of condensation of steam inside air ducts. That, perhaps, calls for a little explanation. In some mills there are arrangements for forcing into the shed a mixture of air and steam.

681. (*Mr. Roberts.*) Through pipes?—Through ducts of some sort. If the amount of air is small, it is necessary, in order that that air may convey the amount of moisture wanted for weaving, to increase the heat of that air. This is done quite unconsciously, I know, or used to be, by a few people; they used to keep blowing steam into the air to moisten it, until they reached a point at which that particular volume of air was saturated. Perhaps, if the volume of air was not very big, it might not be able, at its natural temperature, to carry sufficient moisture for the whole shed, and then they turned more steam on. The effect of that was that some of the steam was condensed, as it could not be taken up by the air; and, in condensing, it gave up heat to the air and warmed the air in that way, and so enabled it to carry more moisture.

682. Have you some objection to that principle?—For the summer, it is obviously undesirable to add heat in that way, but it is not the principle that is wrong. There is nothing wrong in principle in blowing air and steam through pipes. The wrong point is in trying to do it with too little air; in other words, the volume of air must be big, otherwise the air must be heated to carry the moisture.

683. If they have such systems of humidification they cannot increase the volume of air particularly, can they, at one time—the volume of air is constant?—Yes, it is generally constant.

684. Then it is out of their power to increase it?—Yes, the remedy is in the design of the apparatus. The remedy is to design apparatus to deal with big volumes. That, I may say, in modern installations, generally is done.

685. (*Chairman.*) What installations do you refer to?—Any system of blowing mixtures of air and steam into sheds through ducts.

686. You think that is recognised in those systems?—I think in the modern installations that is recognised.

687. Have you any further suggestions to make?—No, I think that covers my evidence.

688. (*Mr. Higson.*) I have just one question, Mr. Williams. What is your opinion as to the utility of that humidifying in sheds: can it be dispensed with?—As regards the process, at any rate with sized goods—I mean sized goods for weight—I think, certainly in dry weather, it is a considerable help to the process. I do not think there is any doubt about that.

689. And goods that are not sized?—Even in goods that are not sized, unless the yarn is very strong indeed, it is helpful in dry weather.

690. (*Mr. Roberts.*) In other words it is helpful to either light-sized or heavy-sized goods?—In certain states of the weather.

691. I mean moisture is helpful?—Yes.

692. However that moisture may be got, it is helpful?—Yes, as a rule. In a few sheds, I was told that the degree of moisture did not influence the weaving; but in most of those cases they were weaving with very strong yarns.

693. And a naturally humid shed?—No, it was not always that. I was very much astonished at one shed in particular where the difference between the wet and dry bulbs was very great indeed, and they told me that they could weave with the air very dry.

694. Possibly then the style of goods might enter into it?—Yes, and more particularly the strength of the yarn.

695. And the style of weave?—Yes.

696. (*Professor Lorrain Smith.*) Have any observations been made as to physics of the moisture—what is the moisture which you are adding to cotton fibre to prevent it snapping?—As a matter of fact, as I have said already, a warp in a weaving shed does not, as a rule, absorb moisture.

697. You are preventing it leaking?—Yes, you are preventing drying.

698. Has the cotton fibre been dried?—The warp has been more or less dried after the sizing.

699. Have you shortened it again?—No. As a matter of fact the drying frequently is not a thorough drying. It is not like a chemical drying, like a chemist would give for drying purposes. It is really sufficiently dry then to go through. In many sheds, as a matter of fact, you could take a great deal of moisture out of the so-called dry warp.

700. Without snapping it?—Of course, if you took moisture from it you would increase the risk of snapping.

701. Is it moisture which a hygroscopic thing would absorb from the atmosphere?—The drying after sizing is just an ordinary drying; it is not a strict drying, not a thorough desiccation, and in many sizes there is deliquescent material which would attract moisture to some extent.

702. But so would the fibre itself?—The fibre itself is more or less hygroscopic, no doubt.

703. You gave us the temperature at which you perceived a feeling of oppression. Have you observed very definitely at what temperatures the weavers begin to make complaints?—No, as a rule in the course of my inspections I had no complaints. Weavers would not come up and complain to me.

704. They are at liberty to complain to you?—We should welcome it if they wished to do it. They would not care to do that in the course of an inspection.

705. (*Mr. Shackleton.*) You get them through a third party?—Yes, as a rule we get written complaints through the Trade Union officials, sometimes from the weavers themselves, sometimes anonymously.

706. Did you observe any rule as to the temperature?—No, speaking generally they came in the summer and not in the winter I think.

707. When you would be over 70° dry bulb and 68° wet bulb?—Yes.

708. (*Professor Lorrain Smith.*) When you got near the limits of humidity, and when the workmen were getting fatigued?—Yes, that is a matter of observation. I would not put it down as an absolute statement of fact. It is simply my observation.

709. We have to deal with two aspects of the question, the bodily discomfort as well as the possible liability to disease of various kinds?—Quite so.

710. What I wanted was whether you could tell us where in the schedule you arrive at a point where definite bodily discomfort arises?—I should not pretend to say that; but up to 70° I certainly on myself never noticed any ill effects in a well ventilated shed.

711. (*Mr. Shackleton.*) I should like to ask you one or two questions upon the point we are on at present. So far as the question of dry sheds is concerned, of course you are aware that there are probably more looms running on dry sheds conditions than on wet sheds conditions?—There used to be about the same number on each system when I was in the district.

712. Manufacturing is going on?—Yes.

713. That proves conclusively that it can be done. You do not say that it is not possible to weave without the Cotton Cloth Factory Act being in operation?—Certainly not; I pointed out in my minutes of evidence that in many of these sheds which are artificially humidified it was found practicable and even desirable to maintain a degree of humidity considerably under the legal limits, and of course a considerable proportion of cotton weaving is done without any artificial moisture.

714. I understood you to suggest that where the dryness was brought about, unless the yarn was somewhat stronger than the ordinary yarn there would be some trouble in the weaving?—In dry weather.

715. Your idea is that in the dry shed the yarn would be of a better character to work the same class of goods: that is your logical conclusion?—I would not be prepared to say that.

716. You would not say there was a less production?—As a general rule in dry weather in a so-called

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dry shed there is lessened production; the weaving certainly does suffer, say, in times of east wind.

717. With regard to the question which arose out of your statement as to 70°, 75° and 80°, I want to call to your mind a case at Darwen upon which I wrote to you several times, and you made several investigations—I do not want to put the name of the mill down. You remember that mill starting?—Yes.

718. In the working of that mill you will remember that frequently after the first year I had to call attention to complaints?—Yes.

719. Could you say whether what I am saying now is correct with regard to difference of working. In the first year they had full apparatus going during the summer with cold water running round the sacking and drawing the air through the wet sacking?—Yes.

720. The other years, when I called attention to it, that was dispensed with; they were drawing in simply from the sun heat, whatever it was, and mixing it with the air inside the shed; did you find that to be so?—I cannot say that is so. My own explanation of the complaints at that shed was that the ventilating arrangements were defective. As a matter of fact, the tests of the air showed that the air was not good. I do not think, on testing, at any rate, that the apparatus they had there was sufficiently powerful; and it is possible in that case that that thing was happening which I tried to explain just now: that in a duct system of distribution, there was actual condensation of steam in the ducts, and therefore a rise in the temperature due to that; and if that be so, it would not be helped at all by any cooling taking place at the entrance of the duct, because that cooling would have to be neutralised subsequently by additions of steam.

721. Can you explain why, in the first year of its operation all was satisfactory, and we found the shed cooler inside than outside?—I could not explain that. Was the shed in full operation at first?

722. Yes, it was a full year?—Was it a cooler summer, do you think?

723. No, on the day I went it was 82° outside and 78° inside?—There must, I think, have been some mistake in that. 82° must have been the temperature in the sun.

724. No, it was not?—I do not think you could have had a shade temperature outside of 82°, and inside 78°.

725. They were using water?—Such a thing I never met with myself as a shed being cooler inside than out.

726. You will find it in Darwen now, with the "Vortex"?—I am surprised to hear that, though that is a system of internal evaporation.

727. You will find that at a certain mill in Blackburn?—I never met with such a case.

728. With regard to the question of gas lights, Mr. Higson put a point to you that he thought some reduction of heat followed on the putting in of the incandescent gas light?—Yes.

729. Is there anything like a reduction—supposing you reduce the number of lights one-half, the heat is not reduced anything like that?—The heat would be reduced practically in proportion to the reduction in the consumption of gas.

730. Does not the incandescent burner give out far more heat than the ordinary gas burner?—Not if it is burning the same amount of gas, and it is, roughly.

731. (Mr. Shackleton.) That is not our experience.

732. (Mr. Roberts.) If there is complete combustion it must of necessity reduce heat.

733. (Mr. Shackleton.) There is more heat from an incandescent burner with less gas?—I do not think that can be; I think the amount of heat will vary in strict proportion to the amount of gas consumed.

734. (Mr. Higson.) How much more heat do you think?—It is a general impression; I think, perhaps, the radiant heat might be a little greater, but the total heat will not be. The radiant heat might be greater on the face of the worker, but the total heat on the air must be the same.

735. Undoubtedly where incandescent burners are erected and the old form of burner removed, in our own case we have reduced our lights by one-half, and without a chemical test I can tell from my own impressions as we go into the shed that we are infinitely better than we were; very much better.—There is no doubt about that both as regards heat and purity.

736. (Chairman.) We are to-day receiving evidence from Factory Inspectors, and before Mr. Williams leaves I desire to say that the Home Office wishes it to be understood that the evidence given is the evidence of the individual; that it cannot be taken as representing any Home Office opinions beyond the individual opinion of the witness who gives it. I was asked to explain that to the Committee. Mr. Williams, if you can help us to get any reliable statistics relating to the health of the people working in those rooms in Belfast it will be very useful?—I certainly will be very pleased to give any help I can.

The witness withdrew.

Mr. CHARLES ERIC PRINGLE, called; and Examined.

737. (Chairman.) You are one of H.M. Inspectors of Factories?—Yes.

738. What particular duties are assigned to you?—I assist in the two cotton cloth districts.

739. How long have you been an Inspector, Mr. Pringle?—Four and a-half years now.

740. I do not want to ask you personal questions beyond the fact as to your former occupation, because we should like to know whether, before joining the Department, you had opportunities of acquiring knowledge likely to be useful?—My training was that of a chemist—an analytical chemist. I went through the curriculum at the Royal College of Science and I entered the Factory Department from the Government Laboratory.

741. Had you any experience with regard to factories before? I mean, had you any knowledge of factories before?—Practically none.

742. Or of cotton mills?—No, none at all.

743. You prepared a paper* which has evidently given you a considerable amount of trouble, and is

very carefully prepared. I think perhaps it has been read by most members of the Committee; I am sorry to say not as carefully read as I should wish myself, because it has been going round and has not come back to me. However, we shall all master it a little later on. I will just read the first paragraph of that report. (Read.) These are samples of CO₂?—Yes.

744. Are these in humid cotton cloth factories or in dry sheds as well?—In both. You wish to know whether they were taken in both humid and dry sheds?

745. The samples of air taken by you between the 1st of May, 1906, and the 30th April, 1907, apply both to humid and to non-humid sheds?—Yes, they were not taken by me, of course, except as regards a certain number.

746. (Mr. Higson.) Tested by you?—No, not tested by me; they are the figures for the whole of the district inspected by Mr. Rogers and myself.

747. (Chairman.) Taken in the district by Inspectors, I will say?—Yes.

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748. Where is that table?—It is tables A and B. Here is "A"—humid sheds; it relates to 416 sheds tested.

749. You hand in the table?—Yes.

750. Will you explain the table "A" please?—The table "A" shows the number of sheds tested in each month, the averages of the dry readings inside the sheds, the averages of the temperatures in the open air at the same time, the differences between those sets of figures in each month, and also the average percentages of humidity at the time the samples were taken.

751. In the sheds?—In the sheds.

752. Now is there any distinction drawn between the humid and the non-humid sheds?—Those are humid sheds only in table "A."

753. And this last column gives the relative humidity in the sheds?—Yes.

754. Are those sheds of all kinds, or are they classified in any way?—They are sheds of all kinds—all humid sheds.

755. Probably amongst the sheds referred to there would be some in which there are heavily sized goods made, some pure sized, and some medium sized?—Practically every shed in the Blackburn Cotton Cloth Factory district is represented in this table, some of them, of course, more than once.

756. Then there is another table, I think. Will you explain the next table?—There is an average for the year given as well as for the months.

757. About the non-humid sheds, table "B" refers to non-humid sheds?—Yes.

758. And gives the same particulars?—Yes, except that there is very little information with regard to humidity.

759. In three cases only is any information given in regard to relative humidity?—Four readings only for the whole year.

760. I take it that the reason of that is that there are no thermometers exposed?—As a rule. I give some information with regard to the humidity of dry sheds in another table later on.

761. There is that table as to the humidity of dry sheds?—Table "C" gives particulars relating to humidity in dry sheds.

762. In what months?—The humidities only refer to November and December.

763. And shows what?—An average of 65.5 per cent. relative humidity.

764. (Mr. Shackleton.) How many readings?—Fifty-one.

765. (Chairman.) Fifty-one different sheds?—Yes.

766. (Mr. Shackleton.) All separate sheds?—Yes.

767. How many readings of relative humidity?—65.5 was the average percentage of humidity.

768. (Chairman.) Do you give any particulars with regard to CO₂ in the dry sheds?—Yes, I do later on.

769. There is a table marked "G"; what does it give?—It gives the volumes of carbon dioxide found in the case of 155 sheds.

770. (Mr. Shackleton.) Are those separate sheds or separate readings?—Separate sheds. It gives monthly averages, and the average for the year as well.

771. (Chairman.) We might just take the average for the year?—The average for the year is 14.6.

772. (Mr. Shackleton.) Of CO₂?—Yes.

773. (Mr. Roberts.) In dry sheds?—These are all dry sheds.

774. (Chairman.) What is this average of 8.7?—That is an average for humid sheds for the same year.

775. That is the same number?—416 tests.

776. And the other was for 155?—155. I can supplement that if the Committee wish by giving them the figures for the whole of last year for the dry sheds; 150 sheds gave an average of 12.5 volumes.

777. (Mr. Shackleton.) Dry sheds?—Dry sheds.

778. (Mr. Roberts.) That was last year?—That was last year. The year I have been dealing with in the figures I have put before the Committee commenced in May, 1906, and finished in April, 1907. I took that year, as I have explained in my notes, because the summer was a better average one than the one we had last year.

779. (Chairman.) Of course we know that in the humid sheds there is generally found mechanical ventilation?—Yes.

780. In non-humid sheds what methods of ventilation, speaking generally, are adopted?—Speaking generally, the ventilation is by ordinary ventilators.

781. Natural ventilation?—Natural ventilation.

782. Do you think it is satisfactory?—It is not. From October to well on in April, as a rule, all these ventilators are closed.

783. You have told us the state of the air. Can you tell us anything with regard to the temperature in those sheds?—Referring to the same series of tests (that is, table "B"), I give the monthly averages of the temperature, and the average for the year, which is 67° Fah.

784. (Mr. Shackleton.) Is that in dry sheds?—The dry sheds.

785. (Chairman.) What is the highest temperature?—The highest temperature given was in August, 1906, 81.5.

786. (Professor Lorrain Smith.) That is an average?—Yes.

787. What did it go to on the hottest days?—I think that is about the figure, probably the highest that would be got—I cannot say. There are only two tests in August, so that one cannot argue from that figure.

788. (Mr. Higson.) What is the difference in the quantity of CO₂ between the periods of October and April when you stated that the ventilators were made up and the period when the ventilators were open?—Those naturally ventilated sheds are practically as good as the humid sheds during those months.

789. I wished to know what is the difference in the volume of CO₂ between the period when the ventilators are closed and the period when the ventilators are open. You said that the ventilation was not satisfactory, because during a certain period the ventilators were closed?—From October to April there were 140 of these tests made, and 15.1 was the average. From May to September it was 9.4 for 15 tests only. We have not spent very much time in sampling dry sheds during the summer months, knowing that the figures usually come out pretty fair. I show graphically on this sheet the quantities of carbon dioxide found.

790. (Professor Lorrain Smith.) It means that the natural ventilation is quite good in those mills?—It is. We expect to find quite average figures.

791. (Chairman.) I think we have taken down the tables, have we not? We have referred to the tables you described as table "A," table "B," table "C," and so on?—Yes.

792. In what district do we find heavily-sized goods?—Blackburn and Darwen principally.

793. (Mr. Roberts.) That is as far as you have come across it?—Yes.

794. (Mr. Shackleton.) Have you been in the Rossendale district?—No, I have not been up in the Rossendale district at all. Mr. Walmsley will give you all information about that.

795. (Chairman.) Have you from your own experience found any discomfort when going through humid sheds at a high temperature?—Yes, I have when they have been at a high temperature.

796. Have you had any conversation with the workers on this point?—I cannot recall any special conversation.

797. Have you heard that the workers complain of discomfort when working in those sheds?—Yes, I have heard that.

798. Do you think that those complaints are justified or not?—I think they are when they are working at high temperatures.

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799. You are referring now to humid sheds?—Yes.

800. Only humid sheds?—Only humid sheds.

801. You state that in one particular there is an erroneous supposition relating to the saturation of clothing?—Yes.

802. What is the erroneous supposition?—The idea that on account of clothes being in these humid sheds they get saturated with moisture: I do not think that that is correct in the degree which is popularly supposed.

803. Have you made any experiments to verify your conclusions?—Yes, I made some experiments myself in a steamed atmosphere, and I have also got one or two manufacturers to make experiments for me as well.

804. What was the nature of the experiment?—I exposed a Vicuna coat (which had been thoroughly dried) in a dense steamed atmosphere, and I found that its increase on its dry weight after exposure for two and a half hours was 5·73 per cent. That was a dense steam that you could not see across.

805. (Mr. Roberts.) Saturated, of course?—Yes, it gave a 100 per cent. reading.

806. (Chairman.) Then some other experiments followed?—Yes.

807. To which we can refer hereafter, I think?—Yes.

808. Are the results the same?—The next experiment is similar, performed on a pair of blue serge trousers; they took up 4·84 of moisture.

809. They were thoroughly dried?—They were.

810. Did they feel dry when they had taken up this 4·84 of moisture; I mean, did they feel dry to the touch when you took them from the warm atmosphere into the cold atmosphere?—No, they did not; they felt damp. May I say that as a matter of fact the experiment was made in a washhouse; I closed the doors and windows and had the copper boiled.

811. (Mr. Roberts.) Did you try any of your tests, say, at a relative humidity of 85 or anywhere about there?—My next test was performed on the same garments during the process of washing when the doors and windows were open. The percentage of humidity then was 92; and after three and a half hours the coat increased 1·91 per cent., and the trousers in that case increased 2·42 per cent.

812. (Mr. Higson.) In the same condition of atmosphere?—No, the humidity was 92 per cent.

813. (Chairman.) You might briefly describe the other experiments, and then we shall have it in evidence?—The other experiments were performed in weaving sheds. In a shed humidified by Matthews and Yates' humidifiers with a humidity of 88 per cent., shawls thoroughly dried in an engine house were exposed for three hours. Shawl "A" increased 3·4 per cent. and shawl "B" 5·22 per cent. on their dry weight.

814. (Mr. Shackleton.) Is that in a humidity of 88 per cent?—Yes, in three hours. The increase in one case was 3·4 per cent., in the other 5·22 per cent., and in shawl "C" 3·33 per cent.

815. (Mr. Roberts.) In all three hours?—In all three hours. A piece of taper's flannel which was taken into the shed at the same time undried—it had not been placed in the engine house—increased 0·73 per cent. only.

816. That was woollen?—That was wool and cotton.

817. You are sure about that, that it was woollen and cotton?—I was informed so by the manufacturer. I understand it is a mixture of wool and cotton, and could be compared with the shawl in texture and material. I merely took that from the manufacturer who made the experiment. Shawls were exposed for two and a half hours in a shed with Hart's humidifiers; but they had been dried in this case in a moderately steam-heated cloak room, not in the engine house. The increase in two cases was 1·47 and 2·55 respectively.

818. (Mr. Higson.) The relative humidity was what?—88 per cent.

819. Going back to that previous test, did you say that you had dried them in the engine house?—The first three shawls were dried in the engine house.

820. (Mr. Roberts.) You are quite sure there was no steam about—usually in engine houses we have steam?—Not much.

821. There are very few engine houses in which you will not find steam blowing?—I do not think so; I was not present when these experiments were made, but the gentleman who made them is very reliable. Those shawls were not my own tests. The next tests were these: shawls were dried in a cloak room and exposed under similar circumstances in a shed humidified with Drosophores. The length of time and the humidity are the same; the increase was 1·04 per cent. and 2·04 per cent. respectively.

822. The same relative humidity?—The same relative humidity.

822a. What was the installation in the second experiment?—In the second experiment it was Hart's humidifier.

823. What was the first one?—Matthews & Yates', and in the third experiment it was the Drosophore.

824. (Mr. Shackleton.) What was your highest percentage of humidity in the case of the 100 per cent. test? You said it was for two and a half hours in 100 per cent. humidity. What was the increase—the highest one?—5·73.

825. Can you give any explanation why a shawl should reach 5·22 with three hours' exposure and 88 per cent. humidity?—I refer to that, if I may quote from my paper. "These experiments indicate that a dried garment will not absorb more than about 5 per cent. of moisture under the most humid conditions. . . . The exception is shawl 'B.' This was, however, hung on a pillar; whereas in all other cases lines or inside walls were utilised." That shawl, of course, was not in the condition that it would be if it were taken off a weaver's back; it had been thoroughly dried.

826. (Mr. Roberts.) Your conclusion is that these clothes do not get as damp as it is supposed?—About 1 per cent. of humidity would be the increase.

827. One per cent. in weight?—Yes, under ordinary circumstances.

828. (Professor Lorrain Smith.) You would not feel that when you took them out?—I should hardly think so.

829. (Chairman.) You have formed some conclusions, I understand, with regard to the relative methods of humidifying by steam and by water spray?—Yes.

830. What had you in view when you considered this question?—The possible reduction in the temperature of the shed by the use of water spray in lieu of steam.

831. What experiments did you make?—I have no definite experiments to refer to. I have comparative tables referring to the conditions found where the different systems are in use.

832. How was this table compiled?—By the examination of the figures taken when the series of samples was obtained.

833. What conclusions are arrived at?—For 283 tests where fans and steam pipes were in use (that would include perhaps three or four where there are no fans, and I have not thought it worth while to separate these) an inside temperature of 69·7° was found. Where Hart's apparatus was in use, for 74 tests the average was 73·9°.

834. (Mr. Roberts.) That is much higher?—Over 4° higher.

835. The first one was steam jets, the second was Hart's?—Yes.

836. Now give us the pipe one, that is Matthews & Yates' or Howorth's?—With Matthews & Yates' seven tests give 69·6°—practically the same.

837. (Chairman.) You had better take them as they come, or you may leave some out.—Shall I give you Parsons' next?

838. Please?—Thirty-seven tests for Parsons' gave 69·6°. Ten tests with Pye's apparatus gave 71°.

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Seven tests with Matthews & Yates' gave 69·6°. Nine tests with Howorth's gave 69·1°. Four tests with Mather & Platt's (the Vortex) gave 70·6°.

839. You refer to 283 tests. At what time of the year were those made?—All through the year.

840. (Mr. Roberts.) You see there are some very important points on that table. Mr. Pringle shows that Hart's humidifier gives 73·9°, against some other figure for somebody else's apparatus. Mr. Pringle started off by taking tests where water is atomised. I thought he was going to show us that water was the coolest test, and he does not in that table.

(Witness.) No, I refer to that matter in my notes.

(Chairman.) My object in going over it now is to enable any member of the Committee to ask questions upon it.

841. (Mr. Cross.) Mr. Pringle says that in a high temperature the complaints are justified. I would like to know what you would consider to be a high temperature where it would be uncomfortable or cause discomfort, 70°, 80°, 85°, or what?—I think I should put it about 75°.

842. It would cause discomfort?—Yes, I think so.

843. Is that the wet bulb or the dry bulb?—Dry bulb.

844. (Professor Lorrain Smith.) What do you mean by discomfort—do you mean going in for half an hour—is it your own experience?—After spending a day in inspecting in summer one does feel exhausted to a much greater extent, but it is very difficult to dissociate the results of the hot weather from the effects of the shed.

845. You never put yourself to do muscular work for four hours a day in one of these temperatures?—Not in a humid temperature. I have worked in a very high temperature under two glass roofs in a very hot summer, and I know it was most trying, even when the roof had been limewashed.

846. (Mr. Roberts.) That was with no humidity?—No humidity; I was not doing muscular work.

847. You were sitting, and you found even in those circumstances in a dry shed it was trying?—It was a glass office in a top floor of a warehouse with a glass roof.

848. You found it very fatiguing?—Very fatiguing.

849. (Mr. Shackleton.) That was mental work?—Mental and clerical. Might I just say something with reference to that point of the atomising of water?

850. (Mr. Roberts.) I should like to know something more about that?—There is one remark I might make. Howorth's and Mather & Platt's are the principal water sprayers, but the latter—that is Mather & Platt's—is only at present in a limited number of

places, and, so far as I know, only in new mills; therefore a proper comparison of its value is difficult to make.

851. Have you said anything about the Vortex?—Mather & Platt's is the Vortex; it is in new mills principally, so it is difficult to compare.

852. (Mr. Shackleton.) We have two new mills next door to one another?—You refer to the — and the —?

853. Yes?—I have examined the records of a new mill; I believe it was the —, fitted with Mather and Platt's apparatus, and found the highest record this year was between 3 and 4 p.m., on the 13th August; the readings were 78° dry and 72·5° wet.

854. Did you try the — mill next door?—No, I have not been able to do so.

855. (Mr. Cross.) With regard to the tests of moisture with the shawl, did you try a fustian pair of trousers to see what the effect would be—I mean cotton corduroys?—No, I was getting some experiments made in a certain mill, but the manager discovered that his scale was inaccurate, so I did not put the figures in. I have two other experiments made on shawls with indicated increases of less than 1 per cent. Those shawls were taken from the weavers' backs.

856. The weavers work in cotton goods, fustian waistcoats and fustian trousers and cotton blouses?—Yes.

857. (Mr. Roberts.) Then you get into another branch altogether; you have to take up the hygroscopic nature of cotton as compared with wool.

(Witness.) I have made no tests, and of course a blouse would not be left off in the same way that a shawl would.

858. From your researches you have evidently come to some conclusion as to which style of humidification is best for all purposes, that is to say, a reduction of temperature on the hot days in the summer months—I do not mean whose make, but the system. Can you give us any idea what conclusion you have come to?—The conclusion I have come to is that by means of water atomising something like two or three degrees reduction can be secured.

859. (Professor Lorrain Smith.) As compared with outside?—No; as compared with steaming systems. The conclusion is a very disappointing one, because the theoretical cooling is not realised. On theoretical considerations there should be a tremendous cooling effect.

860. (Mr. Higson.) How do you explain that—have you any explanation?—I cannot explain it, Mr. Higson, except in this way: that the water is not atomised sufficiently.

The witness withdrew.

Mr. DAVID WALMSLEY, called; and Examined.

861. (Chairman.) You are one of H.M. Inspectors of Factories?—Yes.

862. What duties have you assigned to you?—The supervision of the cotton cloth factories in the Manchester district.

863. The Manchester district embodies, besides Manchester, what places?—It embodies all the South Lancashire towns.

864. How long have you had your present appointment, Mr. Walmsley?—1st April, 1906.

865. You have been an Inspector for a good many years?—Yes, I had charge of all Cheshire for 14 years prior to that. That included all the weaving places in Cheshire.

866. You have had a considerable experience of the cotton trade?—That is so.

867. Before joining the Department had you any experience with regard to cotton mills?—No, slight. I had more experience in the silk trade, there was one humid silk factory that I was manager over; that

was in Macclesfield, the only one, I think, in the trade.

868. You have no doubt seen the last report of the Chief Inspector of Factories in which he quotes some remarks made by Mr. Rogers?—I have no particular knowledge of reading it.

869. I refer to a statement made by Mr. Rogers that there had been a ballot of operative weavers, and that they were practically unanimous in their opinion that their health suffered on account of humidity in weaving sheds?—I saw that in the newspapers long before the report came out.

870. I suppose beyond having read it in the newspapers or in this report you would have no knowledge of it at all?—No.

871. We must start off on the assumption that these weavers had some reason for holding this ballot, and for the conclusions that they arrived at?—I have never been able to understand their reason.

872. You probably do not know what their reasons

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are?—They do not seem apparent from practical experience from meeting with the weavers.

873. I should like to ask you whether, from your knowledge of the humid cotton cloth factories, you think the conclusions at which they arrived were justified?—The conclusions arrived at by the weavers?

874. By the weavers?—Conditions vary. In the well ventilated and humidified shed they are not justified in that assumption; but in some of the weaving sheds I think they would be justified.

875. Does that mean that in some the law is observed and in others it is not observed?—That is not so. In all it may be observed, but there are degrees in humidity and ventilation.

876. We will suppose for the sake of argument that the law is observed strictly; by that I mean that the limits laid down in the table are not exceeded; if that be so, do you think the health of the workers would suffer, or would they suffer bodily discomfort?—I think they would suffer bodily discomfort in some cases. Perhaps I can give you an instance that came under my notice in the summer of 1906.

877. Will you give it, please?—I went into a certain shed in —, and I there found the humidity practically up to the limit. The shed tops had not been limewashed; the steam pipes were uncovered, and were infusing hot steam in; the temperature was very high; it was uncomfortable as far as the heat and the humidity were concerned. All the weavers had got as many clothes off as they really could take off with modesty. The tacklers were all out of the room and under the staircase, and the weavers seemed to be working with great discomfort. I had the steam shut off, and they promised me that no more should be put in till the tops were limewashed and the pipes covered.

878. This I take it was a new mill?—No, it was an old mill.

879. Then the law was not observed in that case?—The law had not been observed. Apparently they were within the legal limit, but there was great discomfort.

880. The discomfort in that case was due to excessive heat?—Excessive heat.

881. Owing presumably to the law not having been observed in two respects?—The heat was greater than it would have been if the law had been observed.

882. There are two elements which are very exceptional, I take it; in the first instance the lime-washing regulations had not been observed, and in the second instance the covering of the pipes had not been observed?—That was so. That was on the 12th June. At that time they were just within the legal limit of humidity. At the time I visited, which was somewhere about 2 o'clock in the afternoon of the 12th June, one of the bulbs of one of the thermometers was broken.

883. Is this the same mill?—The same mill. I cannot give you the exact temperatures at the time; one was 89°–81°.

884. I think perhaps, although this is interesting, it is hardly instructive, inasmuch as it is quite an abnormal condition of things; we cannot suppose that the law is utterly neglected, generally speaking, as it was in this particular case?—No.

885. One would rather deal with cases where the law is observed?—The degree of humidity in this case came within the requirements of the Act, but the temperature was so high that at this thermometer where there was one bulb broken the dry bulb was at 93°.

886. (Mr. Roberts.) I see on the 6th June the dry bulb in the centre of the shed, between 3 and 4 o'clock in the afternoon, was 93°; the wet bulb was 81°; that is the hottest time?—Yes.

887. On the 5th June it was 90° and 80°, 54 per cent., yet they were steaming at that time?—Yes.

888. They increased the percentage of humidity; of course they blow more in to get the humidity back again?—Yes.

889. (Chairman.) Take the normal condition of things; do you think that the workers suffer bodily inconvenience or that their health suffers from work-

ing in humid sheds?—I do, when the temperature is high.

890. The summer temperatures do you refer to chiefly?—The summer temperatures.

891. (Mr. Roberts.) Will you say what you call high?—80°, anything approaching 80°.

892. (Professor Lorrain Smith.) Wet or dry bulb?—Dry bulb.

893. (Mr. Roberts.) You think, then, it begins to become uncomfortable?—It is uncomfortable. Personally I should rather see the scale altered long before you get to 80°.

894. (Professor Lorrain Smith.) When does it begin to be uncomfortable?—I was in a shed this morning: I think it was about 68°–66°. I think that is the limit that they ought to have for 2°. I think after you leave 66° or 68° the limit should be increased between the dry and the wet bulb. When you get to the high temperatures, even though there is a less percentage of humidity in the air, you get a greater amount of aqueous vapour in the air.

895. Does not the weaving require a certain percentage at any temperature?—It does require a certain percentage, but when you get to a high temperature with the amount that is allowed by the Act, you get a great weight of water in a cubic foot over and above what you get at a lower temperature.

896. Does not the weaving require a certain percentage?—Certainly.

897. The wider limit would be useless from the manufacturer's point of view?—Yes.

898. Although you are making it more comfortable?—You see you create a discomfort to the weavers at the high temperature at the expense of, perhaps, improving the weaving. The question is, can you reduce the amount of humidity without destroying the efficiency of the weaving.

899. You would be destroying the efficiency of the weaving by widening the limit?—It might not. I am told by practical managers that the best weaving conditions are somewhat lower than the utmost limit fixed by the Act.

900. And would be what?—Of advantage in weaving.

901. What would the figures be then for the best weaving?—The best weaving, I am told by a number of practical managers, is about a margin of 4° at 70°.

902. If it were 70° dry you would say it should be what?—66° wet.

903. (Chairman.) That would give a relative humidity of what?

(Mr. Roberts.) 78.

904. (Professor Lorrain Smith.) Would you increase the limit beyond that?—I should increase it all the way up.

905. (Mr. Roberts.) That is, I understand, Mr. Walmsley, you would do away with this 88 per cent. of relative humidity altogether, as shown on this table?—Not for the lower degrees.

906. Will you kindly tell us where you would. Begin with 60° dry bulb?—I should think about 66° or 63° it ought to begin to increase the difference.

907. You would have 2° up to that point as shown there between the dry and the wet bulb?—Yes.

908. Beyond 68° you would say 4°?—No, half a degree, say.

909. Up to where?—Really, it must be practically illustrated by an expert.

910. I suppose we are only asking for a matter of opinion now. From your experience you tell us that you think that 68° and 66° is all right?—Yes, up to that figure.

911. When one gets to 69° what would you say then?—I should increase it half a degree.

912. At 69° you would say it must read what?—68°–65½°.

913. 68°–66° you said and 69°–66½°. Where would you take the next half a degree—when your dry bulb was at what?—I should increase all these in proportion. Instead of increasing some of them half a

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degree when you get up to 73° or 74° then increase another degree.

914. Supposing you had 74° dry bulb what would you say there for the wet bulb?—I should think you ought to have another degree of difference at the least.

915. That would be 3½° of difference?—Yes.

916. 70½°?—Yes.

917. You would take the 4° there; that would be your idea; 74°-70°?—I should think more than half a degree at 74°.

918. What would you say?—I should put a degree on at 74°.

919. (*Mr. Roberts.*) You see, Mr. Chairman, at this point in the hot summer days we often have 75° to 80° dry bulb. It is very important that we should get Mr. Walmsley's experience as to what he thinks the wet bulb should be there.

920. (*Witness.*) I can only judge it by the feeling of discomfort one experiences in going into weaving sheds when the temperature is high and it is approaching the limit of humidity. Then there is discomfort.

921. (*Professor Lorrain Smith.*) You solve the problem by widening the limit?—Yes.

922. Another suggestion made is cooling?—Cooling is an advantage, certainly; but where you cannot cool it sufficiently the limit should be widened. I should be more in favour of cooling.

923. (*Chairman.*) You referred some time ago to the fact that at the high dry bulb thermometer readings the number of grains of moisture was much higher than at lower temperatures?—Yes.

924. You also said that the relative humidity at the high temperatures is less?—It is less.

925. Have you formed any opinion or have you consulted anybody as to which condition of things is the better for health: that is a low relative humidity with a high temperature or a low amount of moisture with a lower temperature?—I think that is the position, is it not?—I should think a lower temperature would be preferable with a relative amount of high percentage of humidity. For instance, when I left home this morning my wet and dry bulb was at saturation point at about 40°, but there was no discomfort. I have a list of records during the month of August, 1906, taken at Ashton-under-Lyne, which show the wet and dry bulb giving 100 per cent. of humidity.

926. You referred to the question of damp clothes when hung on outside cold walls. In a large number of the factories there are rooms for clothing, are there not?—Yes, there are; not a large number, comparatively speaking, with respect to the large number of weaving sheds. The number of cloak rooms is not large considering the number of sheds.

927. I think they are required in all factories to be erected or that were erected after a certain date—is not that so?—Yes.

928. Are you of opinion that they should be required for all humid cotton cloth factories?—Yes, I am, or that there should be other suitable provisions made.

929. By "other provisions," what do you mean?—In my annual report (I do not think it got printed) I suggested that means should be adopted whereby the clothing should be kept dry even in the weaving shed.

930. Can you suggest how it could be done?—Yes; I know of one firm in Stalybridge and another firm in Hyde, they have boarded all round the room one and a half or two inches away from the wall, and had pegs put up, and behind the boarding are steam pipes which keep the boarding dry.

931. Do not the steam pipes run up the temperature of the room?—I do not think they would much, because wood is a good non-conductor, and it is entirely boarded up; practically no heat could get out.

932. That refers to the clothing that is taken off on arrival at the mill?—Yes.

933. What opinion do you form in regard to the clothing that is actually worn when at work; does that become moist or saturated in any way?—It does

when you get to high temperatures, because the air contains a larger weight of vapour; and immediately the workpeople go from a temperature, say, of 70° or 80° with a large amount of moisture in their clothing to an outside cold temperature that clothing becomes damp immediately they go out.

934. It feels damp?—It feels damp when you get to a low temperature, because the percentage of moisture is greater. If you get that high percentage of 70 at a high temperature, when you get outside at 40° you may get a percentage of 90 or more than that of moisture.

935. Is not that starting off on an assumption, which may be right or may not, that at a high temperature the clothing does get saturated—in what way would it get saturated, because unless the dew point is reached the clothing ought not to get saturated unless by perspiration?—At a high temperature the clothing would absorb more moisture than it would at a low temperature because there is more moisture in the atmosphere.

936. But it would not be deposited. Clothing may get moist from different causes?—Yes.

937. One is by moisture being deposited, and the other from perspiration?—Yes.

938. If the dew point is not reached, theoretically, no moisture ought to be deposited on the clothing from the first cause?—But their clothing is hung on the cold walls.

939. I am not talking of that now. I was careful to point out that I am speaking of the clothes that they wear?—There is not the same danger in the clothing that they are wearing; there is more danger in the clothing that is hung up.

940. The clothing that they wear would not become liable to get wet from perspiration?—I should not think so while working with it on.

941. Do not you think they would perspire at high temperatures?—Yes. Take the case at —, everybody was perspiring. I was perspiring, and I was very glad to get out of the room when I had made my observations.

942. In a moist atmosphere would that perspiration be carried away or would it remain? A portion of it would be sure to remain, and when you went out it would fall out?—You would get damp when you went out into a low temperature.

943. You say here: "I consider the air too humid at high temperatures, and the margin between the wet and dry bulbs of the thermometer should be increased." You have explained your views upon that point. Then your next point is: "No clothes should be hung on cold or outer walls; wooden racks or boards away from all walls should in all cases be provided, and all weavers should be compelled to use them." That you have explained already, I think.

944. (*Mr. Roberts.*) He has not explained how you are going to compel weavers to use them.

(*Witness.*) I was in a new shed this morning at —. I had taken some trouble with this particular firm in fixing up a satisfactory cloak room, and made a special room, boarded along the sides of the wall, and lined it with pipes between the boards and the wall. Suitable hooks were put on and a suitable number of them. The cloak room is locked up in working hours. I was there this morning during breakfast time, and not half of the workpeople were using the cloak room. When I remonstrated with a portion of the females, they said: "We have never been used to it; we will try to get used to it." There is a certain amount of prejudice against it.

945. We will come to another point. I see that you are of opinion that humidifying and cooling of rooms can be carried on during hot weather by the use of water. That is on such a system, I presume, as the Vortex, or Matthews & Yates', is not it?—No; Hall & Kay's and the Drosophore.

946. And the Vortex?—Yes.

947. (*Mr. Roberts.*) Three systems?—Yes.

948. (*Chairman.*) Do you think that the admission of steam into the sheds materially increases the temperature?—I think so, because the steam must have

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a certain amount of heat in it, otherwise it could not perform its work.

949. Have you put your hands near any of the steam jets as the steam comes in and tested or verified your opinion in that way, or by thermometers or anything of that sort?—I have tested it by feeling near to it. The steam, as a rule, comes from the boiler at boiler pressure, and has a considerable amount of heat in it.

950. (Mr. Roberts.) It is considerably reduced by a reducing valve, is it not?—In some cases.

951. You have no idea at what pressure it comes out of these pipes?—No.

952. (Chairman.) You suggest that no steam should be used for humidifying when the temperature is high. By "high" what do you mean?—When the temperature of the room gets up to 80°, I do not think it ought to be further increased by the use of steam.

953. You then would substitute, if humidity for manufacturing purposes is necessary, some water-spray system?—I should think so. I should like to draw your attention to a very interesting experiment which took place at —, in August, 1906. That was with the use of the water system of Hall & Kay's, which is a water washing system. The manager was rather curious to know the amount of water that could be absorbed by the air passing through it alone, and he picked on two days in August, 1906, and the two days happened to be the driest and most humid. The most humid day was the 17th of August, 1906, and on the most humid day the amount of water that was picked up by the dry air was 63 gallons. On the driest day, the 30th of August, the amount of water picked up was 250 gallons.

954. By what apparatus?—Hall & Kay's.

955. That is a cylinder?—It is a big box. The water is drawn through about 8 inches of asbestos and a water spray is fixed over the asbestos.

956. (Professor Lorrain Smith.) Have you the reduction of temperature?—There would be a reduction of temperature.

957. But have you got it?—These are the observations in the Park at Ashton-under-Lyne; that shows the reading of the barometer and the thermometer.

958. Let us stick to the one thing?—From the 17th to the 30th these are the temperatures; it shows the amount of humidity in the room.

959. Can you tell us how much he reduced the temperatures on those two days?

960. (Chairman.) Let us be clear. I am afraid we are getting confused. We are referring at present to an experiment that was tried at certain works?—Yes.

961. And a certain number of gallons of water were absorbed. Have we done with that question, or can you tell us how much the temperature was brought down by that?—There is the temperature of the shed there, and the temperature of the outside.

962. (Professor Lorrain Smith.) But I want to get it down. The temperature of the shed is given here.

963. (Mr. Roberts.) What was the date?—The 17th of August. The readings outside were 56–55 on the 17th.

964. The readings outside of the dry bulb were what?—56–55.

965. What time of the day was that?—This would be ten o'clock in the morning.

966. Between ten and eleven on that day it shows here 72° dry bulb, 66° wet?—That is on the 17th.

967. (Chairman.) That is inside?—Yes.

968. The outside being what?—56–55.

969. (Mr. Roberts.) So that it has gone up considerably?—You always get it going up through the friction of machinery and heat from the bodies.

970. (Professor Lorrain Smith.) What was the other day?—On the 30th it was 73–68.

971. (Chairman.) At what time?—Ten o'clock.

972. (Mr. Roberts.) On the inside it was what?—On the inside 75–67.

973. (Professor Lorrain Smith.) You see, Mr. Chairman, when they absorbed the 250 gallons they were 2° higher than the outside, and when they absorbed 63 gallons they were 16° higher.

(Witness.) You always get a factor of greater temperature inside; there is the friction of the machinery.

974. (Chairman.) I should not think so. I know many cases where the temperature is brought down below the outside temperature?—If the temperature had been taken at the machine itself when the air was passing through, it would have shown a lower temperature than the outside.

975. Are you able to say how much the inside temperature was brought down by the absorption of this moisture?—No, we could not say how much the inside temperature was brought down.

976. (Mr. Roberts.) You see, Mr. Chairman, it is a very interesting experiment, because when they absorbed 250 gallons of water they kept the inside temperature very near the outside temperature; but when they only absorbed 63 gallons of water the temperature went up 16° as compared with the outside.

977. (Chairman.) 63 gallons as against what?—250.

978. Over what period of time?—The same period—the same ten hours.

979. (Professor Lorrain Smith.) Those observations you have given us were at the end of the experiment, I suppose?—Yes. The manager took them at the time out of curiosity, not knowing that this would be necessary at any time or that they would be brought forward. He was curious to know how much moisture would be absorbed by the air.

980. From what source was this water supplied?—It was town's water.

981. Could the water be used over again for similar purposes?—No. When he got these results he fastened up the ball tap and stopped the water from running in the tank, and measured the water as it was used.

982. A certain amount came back I take it?—No, the water could not come back. The water comes back on the Vortex system. There is no water that would come back with this system, because the water that left the tank was absorbed in the air and driven into the shed immediately.

983. How many gallons were consumed in the ten hours?—250 on the dry day and 63 on the wet day.

984. Has the water to be paid for?—Yes.

985. (Mr. Roberts.) The water would cost about 3d.

986. (Chairman.) Is that all for 250 gallons?

987. (Mr. Roberts.) That is all.

988. (Chairman.) That is not serious.

(Witness.) I have some interesting experiments and results that have been taken with the Vortex and with the Drosophore. I asked about six large firms to make returns with respect to the amount of water given off from humidifiers. Vortex humidifiers —'s with 1,700 looms, 620 weavers—gave off 1,800 gallons of water in ten hours. They have 60 Vortex machines. That works out at 1.07 gallons of water per loom, which is very high.

989. The water cannot be used again?—No, it is absolutely vapourised. There was the — at — (I do not know whether you gentlemen paid a visit to that Company). They have a new shed, newly fitted up, and quite modern. The —, with 1,400 looms, and the approximate number of 450 weavers consumed 1016 gallons in ten hours. They have 41 Vortex machines. That gives 0.72 gallons per loom.

990. That is rather less?—Rather less.

991. (Professor Lorrain Smith.) Have you got any temperatures for these experiments?—Yes. I will give you the temperatures. The temperatures were 66–56.

992. Is that outside or inside?—Inside.

993. And outside?—I have not got the outside temperatures; those were not taken.

994. You might give me the inside temperature for — on that day?—It was on the 26th December. The inside temperature for mid-day was 63° dry and

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56° wet. The —, 1,900 looms, 642 operatives, used 1,710 gallons from 57 machines. That works out at 0·9 gallons. That was on the 3rd of January. The hygrometer in the middle of the day was 63·57. There is a new place in —, just going, —, 577 looms, 195 weavers, 282 gallons, 21 machines. They used 0·5 gallons per loom. The temperature was 61·57. The lowest that I have any record of is the —; they have 1,386 looms, 500 weavers, they used 270 gallons, which is 0·2 gallons per loom. Their temperature was 66·59. You see a very—very large margin there. There is very little moisture there. I may say that — took up with Hall and Kay's apparatus more moisture than the — with the water spray.

995. (*Chairman.*) In one case the water can be used again?—This can be used again except what was vapourised.

996. You have, of course, some knowledge of dry sheds?—Yes.

997. With regard to the ventilation of those sheds, what opinions have you formed?—As a rule they are very bad. I was in a modern shed the other day in Accrington; it was a dry shed; they have twelve fans fitted in the room; and I have never seen them working yet.

998. At Accrington?—At Accrington. They have not been working, to my knowledge, since they have been erected. They may have been. I was there just about the dinner time, and I could smell the fumes of the gas from the same morning. The fumes had not gone away; the air had not been changed. It was a still day. There was no current of wind, and the gas fumes had not got away from the room.

999. Have you any other points you would like to bring before the Committee?—With respect to the complaints that some of the weavers make, I had a complaint sent to me with respect to a firm exceeding the humidity. The complaint stated that the firm had exceeded the amount of humidity, and here is the letter. I paid a visit to the firm, and found that during the month, in their four sheds, not one of the sheds had the humidity coming within two degrees of the limit.

1000. You were taking their own records?—Yes, I was taking their records for the month, and my observations during that day. I asked the firm if they would send me a copy of their month's records.

1001. What did you actually find for yourself, because you know, of course, it is sometimes said I hope that the statement is not correct (that people do not always return those records correctly)?—In this case it could not be an excess of temperature, because in all their sheds they have what are called Jacquard machines. A Jacquard machine is a loom that is operated upon by long threads. If you get a large amount of humidity up to the amount that the law will allow, the threads creep up, and you cannot weave, because there would be no shed for them.

1002. (*Mr. Roberts.*) Of course, the effect is caused exactly as Mr. Walmsley says, that is, such a cause is effective; but it is not caused exactly in the same way that he explains. The moisture does not affect the harness itself so much as what we call neckbands at the top of the harness, which are about 6 inches long. That is where the moisture affects the harness; it is in that 6 inches.

1003. (*Chairman.*) The substance of the thing is that you received a complaint; that on investigation you found there was nothing in it?—There was nothing in it; there could not possibly be.

The witness withdrew.

Mr. JAMES HENRY ROGERS, called; and Examined.

1014. (*Chairman.*) You are one of H.M. Inspectors of Factories?—That is so.

1015. At present in charge of the Sheffield district?—Yes.

1016. You were formerly where?—In charge of the

1004. Are such complaints common or otherwise?—They are not very common.

1005. Was this a signed complaint or an anonymous complaint?—It was anonymous.

1006. Do you receive many complaints of that kind from the Trades Union officials?—No, they are few; I find, on the contrary, that the firms complain of the weavers tampering with the steam.

1007. Turning it on more?—Turning it on. I was in a weaving shed yesterday. They were up to the limit. I drew their attention to it. They said, if we turn it off the weavers will turn it on as soon as our backs are turned. That was yesterday. Last year there was a firm at —. I had drawn their attention to exceeding the limit of humidity.

1008. Was that in summer?—They wrote on the 31st of August, "We have yours of the 24th instant, and beg to say that we are guarding against a repetition of the contravention of the Act by making the steam inaccessible to the weavers, who were themselves really the offenders." I made personal investigation of this, and found that the employers had taken the steam tap out of the shed, and had taken it up into the ring room away from the weavers, so that they could not use it. There was another here on the 23rd of November. I was at the firm yesterday. I drew their attention to excess of humidity. It says: "Our manager, who has charge of the hygrometer, reports that during a temporary absence from the shed the weavers had interfered with some of the steam jets and opened them more fully, thus causing an excess of moisture. We regret that this has occurred, and I have instructed him to use the utmost care in future."

1009. (*Professor Lorrain Smith.*) What was the motive in opening the steam jet?—Then the threads are more pliable, the cloth will weave with less breakage.

1010. (*Chairman.*) Do you think they wanted to make the room warmer?—I do not think that is the cause of it. I think it is simply because they wish to get a greater production; the looms can be kept running with fewer breakages with humidity.

1011. (*Mr. Roberts.*) Boiling it down into a nutshell, what system of humidity do you prefer in your experience, steam jets or what?—It is a question—one does not like to say —

1012. We do not ask you the name of any particular firm. For instance, there is a system of steam jets. We all know what that is. There are trunk systems, duct systems, pipe systems, whichever you like to call it, and there is atomising of water. We will put it under those three heads. You can call it what you like. I think those cover the systems?—Although it may have its drawbacks for cleanliness and light, I think the most satisfactory that I have seen is the trunk system, especially if you can get a system of ventilation without creating moisture in the pipes. There are some systems that create moisture in the pipes; the pipes are wet inside, and they get rusted away, and the water drips from the pipes, and it is not very nice. If you can get a system of ventilation from the ducts so that the pipes are kept dry, that is the most acceptable way, I think. There are some systems with ducts, and you cannot ventilate successfully unless you have steam in. The system does not allow the air to pick up sufficient water.

1013. (*Mr. Roberts.*) With which system would you consider you would get the best cooling effect on the hot summer days?—The Vortex, and Hall and Kay's.

Blackburn Cotton Cloth Factories District for just over two years—just under two and a half years.

1017. I think in your early service you served in the Manchester district for a considerable time?—I had charge of the Manchester district for six years.

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1018. I take it that in the latter part of your service, that is, when you had charge of the Cotton Cloth Clauses of the Factory Act, you devoted much more attention to these questions than probably you did in former years?—That is so.

1019. In your report for last year you mentioned that a ballot had been taken of the operative weavers?—I did.

1020. Do you remember from what source you got that information?—I forget whether from the newspapers or not, but probably from the newspapers, and confirmed by printed reports issued by the Associations. Reports were sent to the local office. It was my duty to keep the Home Office acquainted with everything that went on affecting regulations in the district. That is why I referred to the matter.

1021. Do you remember exactly what the statement was—that there had been a ballot of how many people?—I am afraid I cannot pledge my memory. If you had the last Blue Book here I could find it. I think 68,000.

1022. (Mr. Roberts.) 68,000 for the abolition of steaming; 3,000, in round figures, against, and 1,300 neutral?—I can say from memory that those are approximately correct figures.

1023. (Chairman.) We can correct the figures afterwards. At any rate, it showed overwhelmingly that the operatives, rightly or wrongly, thought that they suffered in health on account of the humidity in the sheds?—That is so.

1024. Do you know at all how that ballot was managed, or how the papers were collected, or how the individual people recorded their opinions. I gather that the work was done by post?—Ballot papers were sent out, but I am quite uncertain on that point.

1025. I think we may take it that, rightly or wrongly, the weavers think that they suffer in health from the excess of moisture?—I was certainly satisfied of that from other evidences than that of the ballot.

1026. That they think so?—That they think so.

1027. Will you be kind enough to give us your opinion upon that point?—Well, it is very difficult for me to express any opinion as to the effect on their health. I had no cases of definite illness brought to my notice. I received many complaints of illness, but they were all indefinite, and they related mainly to the extreme heat in the summer time. They alleged lassitude and a general feeling of slackness more than a definite injury to health.

1028. Can you express any opinion in regard to bodily discomfort?—Yes. I certainly noticed that in myself and in the appearances that the operatives presented to me. I experienced bodily discomfort when the humid shed temperature exceeded 70° by more than, say, 2° or 3°. It was in the neighbourhood of just over 70°.

1029. At just over 70°; is that dry bulb?—That would be dry bulb.

1030. (Professor Lorrain Smith.) And the wet bulb would be what?—About 69° to 70°.

1031. (Chairman.) Then you began to suffer bodily inconvenience?—Yes, roughly at a wet bulb temperature of 70°.

1032. (Professor Lorrain Smith.) What would you be doing then—were you working as actively as the weavers or were you standing or sitting about in the shed?—Hardly; not quite as actively as the weavers, but nearly, I should say. I had much work in air testing, in climbing ladders, and so on, putting my thermometer in the fan tubs, perhaps more than we have in the ordinary factory inspecting work. Then I had to get the speeds of fans, and so on. The amount of my exertion would be somewhat less than that of the operatives, perhaps.

1033. They would suffer correspondingly more discomfort?—To that extent, yes. Their clothing may have been slightly more suitable for the atmospheric conditions, and that would counterbalance, perhaps.

1034. Then would you be in this atmosphere an equal time?—Of course, it would be in my favour

that I was not in the atmosphere more than half an hour or an hour, then I went outside. That is in favour of its having less effect on myself.

1035. (Mr. Roberts.) You, in climbing ladders, would be really doing more than a weaver?—That is so, when I was climbing ladders, but I was trying to average the amount of exertion. I did not have to climb ladders in every shed, but I had some of that work to do, and the mere presence in the shed and leisurely walking about as inspector doing ordinary work apart from ladder climbing did seem to affect me at that point.

1036. Is that the point at which you find weavers' complaints coming?—Roughly. It is very difficult to identify the point.

1037. About 70° wet bulb?—About that—it would be 73°. If we could fix 70° it would be 73·5° dry, about.

1038. (Chairman.) Under the heading of humidity, you say humidity is needed only because of sizing for weight, and in proof of that assertion you refer to Burnley and Nelson practice. In Nelson and Colne they are dry sheds?—They are dry sheds. I should like to qualify the words "for weight." I do not mean to use the word "weight" solely to indicate adulteration, if I may use the word. Weight is added frequently to strengthen the cloth or stiffen it. I used the word weight in that sense. I do not want to be misunderstood as meaning that weight means adulteration necessarily.

1039. In Burnley, is not it common to use artificial humidity?—It is not common; it is most uncommon in Burnley.

1040. It is uncommon in Burnley, Nelson and Colne?—That is so; it is, in fact, absent in Nelson. In my time there was one factory in Colne humidified, and either one or two in a village near Nelson out of a total of perhaps 200 to 300 factories.

1041. All dry sheds?—All the others were dry except those three.

1042. Are there any particular conditions in those three towns—I mean do they manufacture particular classes of goods so that artificial humidity is not necessary?—Yes, there are special conditions. The goods manufactured are much lighter; the sizing is very much less; the percentage of size added is very much less than in districts where humidification is common.

1043. (Mr. Roberts.) I should like to ask at this point, in those lighter sorts, Mr. Rogers, you think then from your answer that it is not necessary to humidify?—The fact that the manufacturers there do not humidify, and very many of them have made no attempt to do so, appears to prove it to my mind.

1044. I presume you are aware that many manufacturers in Burnley have attempted to humidify?—Many have and many have not.

1045. But those who have attempted to humidify in Burnley, and have humidified, putting in very expensive plants for the purpose of humidification, have been stopped by the action of their weavers?—That is so.

1046. Do you know why?—Yes—well, I have an impression that they object to humidifying by steam: that they object to steam. That is another proof that operatives object to steaming.

1047. I think we understand that in Colne and Nelson the reason there is no humidifying is that it is objected to by the operatives?—May I answer, Sir, that I am not aware of any material attempts on the part of employers in Colne and Nelson to humidify. In Burnley there have been such attempts, and humidification has been practised to a certain extent in Burnley, but not in Nelson and Colne.

1048. (Chairman.) We shall have evidence from Colne and Nelson on that point later on. In your annual report for last year you made some reference as to the point at which artificial humidity seems necessary?—That is so.

1049. From what source was your information obtained?—From the manager of a factory at Blackburn, who had carefully recorded the state of the shed

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atmosphere, though he was not required to do so by law, as the place was non-humid.

1050. Is this gentleman's name published?—I have given it to the Secretary—

1051. I mean in the annual report?—No.

1052. The name of your informant is not published in the annual report?—No.

1053. Do you think that he would have any objection to your giving his name to this Committee?—Not at all; I do not think so.

1054. Would you be kind enough to mention it so that we can ask him to give us first-hand evidence?—

1055. (*Mr. Roberts.*) Is that —?—It is now, but I think they still trade as the—

1056. (*Chairman.*) You say that the schedule allows a greater percentage of humidity than is necessary. By the schedule you mean the table of humidity in the Act of Parliament?—Just so.

1057. And you say that is proved by the fact that many firms keep well under the limits?—That is so; that is my experience.

1058. (*Mr. Roberts.*) At the — Mill, I think, Mr. Rogers, they have more than one shed?—That is so; they have two sheds.

1059. They are sheds that are very peculiarly built?—They are.

1060. Can you tell us how they are as compared with other sheds?—I imagine they would be much moister. The ground seems to be much more moist there than the average, I think, and they have flat roofs. The roofs are leaded, and are kept covered with water with projecting skylights through the water-covered roof. That conserves the natural moisture that arises from the damp ground, and so has apparently enabled the factory to work, though doing heavy sized yarns—I mean to work without artificial humidity.

1061. (*Professor Lorrain Smith.*) It keeps cooler?—It keeps cooler, too, in summer; but the construction of the factory renders ventilation most difficult, and so we got very very bad CO₂ results at that place. The occupiers were requested to ventilate, and then they found that by ventilating they lost their natural humidity. Now this is the evidence you would get first hand that I am being led up to now. But you can have it again. The manager and the occupiers took great interest in the matter. They found that when the percentage of humidity that is the percentage of saturation fell below about 68 or 70 per cent. of saturation with ordinary weaving temperatures, say 67° or 70° dry, that weaving got bad. These are their own words: "the ends began to break," and so it was found necessary to close up all means of ventilation to conserve the natural humidity of the shed, and to prevent too much of the outside air entering the shed, and so reducing the percentage of saturation further.

1062. (*Mr. Roberts.*) There are two sheds here?—There are two sheds.

1063. Did they not eventually humidify one of those sheds?—Yes, in my time, one of them. They did the experiments in one of the two sheds. The larger shed was left as it was. Of course, we tried first of all to ventilate without introducing humidity, but it was found that when the temperature of the outside air was 40°, whether that outside air was saturated or not, the fans had to be stopped, because air at that temperature can contain less than three grains of moisture per cubic foot. To weave you wanted roughly five and a half to six grains—that is to weave their class of cloth at the average weaving temperature. I believe they size with a medium size.

1064. In your experience of this shed, then, it was apparently proved that when they came to ventilate the shed it was impossible to weave without using artificial means for humidification?—Yes, it was impossible to weave under the same conditions certainly.

1065. (*Professor Lorrain Smith.*) Your statement is an important one about the grains per cubic foot, because I do not think anybody else has said that. We have hitherto been told that you wanted some-

thing like 70 or 80 per cent. of moisture.—In this factory they found that at 70 per cent., as I said in evidence, weaving got bad. That indicated to me that weaving might be possible at 70 to 72 per cent. or 71 per cent. They kept their fans going.

1066. Assuming that that is so, you have added to that the absolute statement that five and a-half to six grains was necessary?—About that.

1067. That limits the weave?—At weaving temperatures.

1068. You will not get the moisture in at a lower temperature. You see by the time you get to 60° you can have in only 5·1 grains?—You can never weave at 60°; you never weave much under 65°. 65° would be below the average weaving temperature. And that is the temperature that I explained that my evidence related to—68° to 70°. At that temperature the air apparently needs to hold or to have in it 5·5 to 6 grains of moisture per cubic foot. When the air is at 70°, 70 per cent. of saturation would be between 5·5 and 6 grains. At 60° it would be less.

1069. Assume you are at 60° temperature, according to the legal limit you would have 88 per cent. of saturation?—Yes.

1070. Still, you say you could not weave at 88 per cent., because you have only 5·1 grains of moisture?—I said at average weaving temperatures you need about 5·5 grains, meaning by average weaving temperatures 65° to 72°, or 66° to 72°.

1071. Still you say you could not weave at 60° successfully?—They do in the non-humid sheds in the winter time. I do not know any humid sheds, or very very few—a few tiny ones—where they ever get as low as 60°, or at any rate ever below 60°, except in the early mornings of cold days.

1072. (*Chairman.*) Returning to the point, you are of opinion that the schedule, by which I mean the schedule of humidity in the Factory Act, allows a greater percentage of humidity than is necessary?—That is so, but my only evidence is that so many factories are able to keep several points below it, and are able to keep below the limit. I have never made any experiments in that direction.

1073. You say you cannot help to frame a new schedule?—No, I am afraid I cannot.

1074. Then you make certain suggestions; one is humidifying by evaporation of water instead of steam, and cooling by the same means in steaming sheds?—That is so.

1075. That I take it is intended to meet excessive heat in summer?—That is so.

1076. You suggest an improvement in white-washing and pipe covering. What suggestion do you make with regard to white-washing?—I would extend the period to the middle of September at least.

1077. And what with regard to pipe covering?—I suggested to the Home Office and to the Secretary of the Committee that experimental tests should be made with the object of obtaining a standard, and then fixing a standard of pipe covering in the terms of temperature above shed temperature.

1078. When you suggest experiments, do you mean that the pipes should be covered with different non-conducting materials and the results watched?—That is so practically.

1079. Are you of opinion that the non-conducting material generally used now is inefficient?—No, I would not say that. It is in some sheds. It is certainly defective in some sheds. In the best sheds the pipe covering appears to be pretty good; but there appears to be much room for improvement in that respect, and also much want of evidence as to what really is a good pipe covering. Of course, a Factory Inspector in charge of a district has not much time for work of an experimental character. The ordinary work of the district has to be kept going, and he cannot leave it. I started some experiments of that kind, but they did not proceed far enough for me to give the Committee any very useful evidence on the subject.

1080. Are you of opinion that there should be a standard of ventilation in non-humid sheds?—Yes, I am.

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1081. Is there any reason why in the non-humid sheds there should not be the same standard as in the humid sheds?—There is. At present the standard in humid sheds is 9 volumes of CO₂ to 10,000. To attain that standard great volumes of outside air have to be poured into the shed. I am afraid that the non-humid sheds could not be carried on—that weaving could not be carried on under present conditions in the non-humid sheds if the amount of outside air necessary to reach the 9 standard had to be provided. But it is possible in my opinion to reach a 12 standard in those sheds without interfering materially with the processes carried on there.

1082. Then you would recommend for the non-humid sheds one of two things: either that they should have a standard of ventilation to be fixed after consideration, or that they should place themselves under the humid cotton cloth factory regulations?—That is so, then they would have the 9

standard, of course. I think this standard should be retained for the humid sheds.

1083. One of two things?—That is so.

1084. (*Mr. Roberts.*) That would practically compel the non-humid sheds to become humid sheds?—No; I said assuming a standard of 12 volumes were fixed as recommended by the ventilation Committee, I think that the non-humid sheds could be carried on under present conditions, because only roughly five-ninths of the amount of fresh air would be required for a 12 standard as for a 9 standard. My experience, anticipating your question, is that it is quite practicable. It has been done in many non-humid sheds, and I understood that it was admitted by the manufacturers. Many of them have been very good in making experiments, as I have shown in my reports. They themselves have proved that it is quite practicable, and that is how the case presents itself to me.

The witness withdrew.

Mr. GEORGE ALLEN TAYLOR, called; and examined.

1085. (*Chairman.*) You are one of H.M. Inspectors of Factories, as we know?—Yes, sir.

1086. How long have you been in the Department—I forget?—About fifteen and a half years.

1087. In what districts have you served chiefly?—Ireland, the Dublin district; London, Central, Eastern, Western; Burnley, Blackburn; a time in Liverpool, a time in Manchester.

1088. Now you have some particular duties assigned to you, I think?—I have.

1089. What are they?—As Inspector under the Cotton Cloth Factories Act for the Blackburn Cotton Cloth Factory District, as it is now called, embracing the old Blackburn district and the old Preston district.

1090. How long have you held your present appointment?—Since October last.

1091. Then I take it that it would be perhaps rather a limited time for you to have formed any definite opinions in with regard to questions of humidity?—Yes.

1092. So far as they affect the health of the operatives, I mean?—Yes, the time is rather limited. Of course, I have altogether been visiting cotton cloth factories since August, 1898, but not for the purpose of analysing or collecting air.

1093. And you know, of course, that there is a widespread feeling amongst the weavers (whether a right feeling or a wrong feeling, we have to decide hereafter) that they suffer in health on account of working in humid sheds. At any rate the feeling does exist?—I know that by hearsay.

1094. Have you formed any opinion as to the merits?—I think there is more injury from a theoretical point of view than from a practical point of view. I mean to say, a lot of it appears to be imagination.

1095. I need not explain to you the different methods of humidifying, because you understand that; but have you formed any preference for one over another; when I say preference I mean from the point of view of health and comfort?—I think I have. For the purpose of comfortable humidification and the admission of air in factories, my opinion is that the old system of humidifying, that is to say, by steam cocks on the main pipe and a number of fans placed in the roof—I should prefer the fans to be propellers rather than extractors, and, if possible, to have the air warmed in winter by a coil of pipes inserted in the tube above the fan. In summer, of course, the steam could be cut off, and fresh air brought in by those fans.

1096. That means plenum ventilation and the insertion of live steam?—Live and dry steam.

1097. It has been represented to the Committee that in summer the heat is excessive, and that a system

of allowing live steam rather tends unnecessarily to increase the temperature, and that humidifying with water would tend to lower it. What do you say about that?—Some spinning mills that I visited last summer, in which they have humidification by cold water, had a much lower temperature inside than the temperature of the outside atmosphere.

1098. (*Professor Lorrain Smith.*) How much lower, Mr. Taylor?—I should say that it would be about 6 points lower.

1099. (*Mr. Roberts.*) Six degrees?—6° lower.

1100. What system was that?—That was by the Ashton-under-Lyne people, Hall & Kaye; it is in operation in Blackburn.

1101. (*Chairman.*) You say that is a spinning mill?—Yes.

1102. A ring spinning room?—Yes.

1103. What counts?—I think they spin about fifties and sixties there.

1104. Naturally the temperature in that room would be very much above the outside temperature, would it not?—Without the humidification, yes.

1105. I mean the friction from the spindles would create heat?—Yes; a ring room is excessively hot without ventilation—excessively hot—more so than a mule spinning room.

1106. You found that this system of ventilation brought it down below the outside temperature?—That is so.

1107. Were there any complaints that impurities were brought in with the air, and so affected the cops?—No; the air is brought through a sort of large box apparently containing asbestos cobbles.

1108. We have seen it and know it, so it is giving you unnecessary trouble to explain it. What we do want to know is whether after the washing and after the treatment it has gone through any impurities likely to affect the sales of the cops are brought in?—No, there are no complaints. I understand spinning pretty well. I have been brought up in it myself, and, as a rule, I look at these things, and I did not see the cops blackened. In a spinning mill on a day like this you would see the cops very black towards the bottom of the cops, especially on the part that has been on the spindle longest.

1109. I think you said you were brought up, to some extent, in the cotton trade?—I was.

1110. And you have a knowledge of good and bad material?—I have.

1111. Of the warp and weft?—I have.

1112. It is sometimes stated to us—I do not know whether correctly or otherwise—that the necessity for humidity arises from the fact that inferior material is used in many instances because it is cheaper, and it is very likely necessary to produce these cheap

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cloths; that there is a demand for them, and so long as there is a demand it will be produced. Do you think that affects the question at all?—On the question of good and bad yarn, the last crop was rather a poorer crop; the cotton seems to be growing worse year after year—I mean to say, as a whole, cotton seems to grow worse; and, of course, with an inferior quality of cotton it may be, and I think it is necessary to add a little humidity so that it will carry. Of course, with good-sized cotton it is necessary to have a humid atmosphere to keep the yarn pliable.

1113. (*Professor Lorrain Smith.*) There is only one point occurs to me to ask you about. Have you noticed whether the clothes, the shawls, and so on, hung up in a humid atmosphere get damp?—I have noticed it, more especially with those humidifiers where the steam is of a local character, that is to say, where there is a great volume of steam in a closed space rushing against a pillar, and there you would find that water would be running down the pillar.

1114. But I mean hanging in the atmosphere without any cold object near—the things they hang up?—Unless it is a case of that sort I have not found this dampness in the clothing. It always struck me that where you had a large humidifier pouring out large volumes of humidity in the shape of steam with a mixture of cold air or warm air, immediately it strikes a pillar you find water. You find it round the pillars often. Take a pillar six yards away from a humidifier, you will find water at the base of it. If operatives hang clothes in a shed they are bound to hang them on a pillar. I do not know where else they could hang them.

1115. Their complaint is that when they go out in the cold air their clothing feels damp?—If they hang them on an outside wall which is partly covered by earth outside you will get moisture there. If the wall is dry and above ground, I do not think there is much complaint. I mean to say we examined that very carefully as to the position of the hygrometer which hangs at the end of the shed. I do not think that the operative, unless it is a case that I have pointed out, has complained of wet clothing.

1116. (*Mr. Roberts.*) You seem to think that there is greater danger of dampness from Hart's humidifier or a pipe humidifier or a trunk or a duct than there is from the steam jet?—Not so much from a trunk or a main duct as from a humidifier which is hanging, say, from the roof, and throwing its humidity or steam into a confined compass.

1117. Would you class along with Hart's in that sense in a confined compass such a one as you have in —'s Mill?—That is the Vortex, of Mather and Platt. I understand in the case there—I got this from a good source—at times they can actually feel the water spraying upon their faces.

1118. In your opinion you consider the steam jet is the best system?—I do.

1119. What about the hot days of summer?—In regard to the steam?

1120. Yes?—I think if they have fans on the plenum system there is not much justifiable complaint. Of course it all depends on the amount of steam. They must keep within the tables.

1121. We are always presuming in our questions that they are within the Act. Have you had experience of dry sheds?—I have.

1122. Non-humid sheds I mean?—Yes, more so than humid.

1123. How do you find the ventilation there?—They are beginning to ventilate now. Hitherto there has practically been none.

1124. They are beginning to ventilate on what system?—Principally on the extracting fan system. They complain of the other system.

1125. They complain of the plenum system?—Yes.

1126. Even if the plenum fans have coils in?—No, there is not so much complaint then. There are not many with coils in. I have tried to find a few places. I was in a shed the other day where they had 14 plenum fans without coils, and they were all stopped. That is, of course, in winter.

1127. (*Mr. Higson.*) Many trunks have fans in them, but the coils are not working?—The trunks I refer to have no coils in. In that case the fans were placed at the option of the weavers, and the manager said that the weavers had knocked the belt off.

1128. (*Mr. Roberts.*) In any of these non-humid sheds where they have been ventilating, have you tested for the difference in CO₂ before the ventilation and after?—I have a good answer to that. It may not just meet your question. I tested a tenement factory by request where there are four tenements, and in one of the sheds there was a system of ventilation by propelling fans, and a trunk running through the centre of that shed in the form of Hall and Kay's without the humidification, and that showed that the result of the analysis by the Haldane system was 6 parts. Two other sheds connected with this one by the ordinary low wooden partition of about 8 feet, and those two sheds, without ventilation other than a little natural ventilation, gave me 9 parts. There were two other sheds partitioned by a brick wall without ventilation other than a few Tobin tubes and one or two ventilators. There were more ventilators, but most of them were made up, and the result turned out to be 14 parts.

1129. (*Chairman.*) Presumably the ones separated only by a partition got some of the benefit of the ventilation in the ventilated tenement?—Yes. You see the partitions were about 8 ft. high, not more.

1130. (*Chairman.*) I know the place.

1131. (*Mr. Roberts.*) You have been in Burnley a good deal?—I have.

1132. Some of those sheds in Burnley have been humidified, I think?—Yes.

1133. Were they humidified in your time?—Yes.

1134. Did you hear any complaints from the weavers at the time that those sheds were humidified?—I had no complaint delivered to me personally.

1135. Were you there in some cases when the humidifying was stopped?—I was.

1136. Did you get any reason for it being stopped?—No.

1137. Can you give us any opinion as to the conditions of working between one way and the other?—Yes. My opinion is that a ventilated shed with humidity not above the table is a more healthful shed than a dry shed. I was in a Colne shed the other day where they weave sheetings, and I could actually see both the sizing and the fibre in the atmosphere.

1138. Flying about?—Yes. I have inspected factories at Todmorden. In Todmorden they size pretty heavily; in many instances I could not see the further wall; I could not see the length of the shed. Entering the door, it was impossible for me to see the further wall. My sight was obstructed by sizing and fibre.

1139. (*Mr. Higson.*) Had they no humidity there?—No humidity at all.

1140. (*Chairman.*) That was a weaving shed at Todmorden?—Yes.

1141. (*Professor Lorrain Smith.*) With heavy sizing?—Yes. I do not know whether they always size sheeting heavily. I looked at the cloth at the Colne place the other day. It was not a very very thick sheeting. The shed atmosphere was very bad. The sheeting appeared to me not to be heavy. I mean to say I have a note to suggest a humidifier there in order to take out those impurities.

1142. (*Mr. Roberts.*) And you think it is more detrimental to the health of the operatives to work in a dry shed where they have those impurities floating about in the air than to have a humidified shed where those impurities do not appear to exist?—I do. Of course, I always couple with it that they must keep well within the tables.

1143. You say, "Well within the tables"; what do you consider is a proper temperature to work at?—The most comfortable temperature to my mind is 70°.

1144. That is dry bulb?—Dry bulb, 70°.

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1145. What would you have the wet bulb read at that time?—66°.

1146. That is a lot within the Act?—It is two points below. I mean to say, I often find 70 and 66.

1147. You would not object to 70-67 then?—No, not at all; but I am going to my limit now.

1148. 70-66 for 70-67 you say?—Yes.

1149. During the hot days of the summer months what do you say about the high temperatures that are got then. I suppose you have experience of high temperatures in those months?—If you approach 80° you are getting uncomfortable.

1150. What do you mean by approaching?—You begin at 78°.

1151. What would you have at 78° to be uncomfortable; what would you have the wet bulb standing at?—73°. It is oppressive to the factory inspector as well as to the operative, or it may be

even less than that, because the cotton fibre when warm does not require the same amount of humidity really. Cotton fibre contains a natural wax, and it grows in a sort of screwed form—shall I say a spiral form—I mean the fibre itself. Of course, a certain amount of its nature has been taken out of it when the manufacturer gets it. The fibre itself works better when warm rather than cold. You must have heat for cotton. It is grown in a hot climate, and it will not work unless it is hot. You cannot work it—I mean to say successfully. But I want my humidity lower when I get heat.

1152. (*Professor Lorrain Smith.*) At that point it is desirable to cool?—Yes. You see cotton will not spin unless you get a fairly medium temperature—I mean medium for the trade—that is 70° about; otherwise you cannot work it; it will break. The fibres have a tendency to leave one another; but if you get heat the natural wax begins to act, and the fibres cling naturally and carry forward.

The witness withdrew.

Adjourned.

FOURTH DAY,

Wednesday, 5th February, 1908,

At Manchester.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
Mr. H. HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor J. LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

The *Chairman*: The operative weavers to be examined on this day were selected in the following way:—

The *Chairman* and the *Secretary* of the Committee, when visiting sheds, took the numbers of the looms

at which suitable weavers were employed, and the firms were subsequently written to and asked if the weavers at those particular looms would attend to give evidence.

Mr. S—— B—— called in, and examined.

1153. Are you a weaver?—Tackler—an overlooker.

1154. In what mill?—Mill, —.

1155. That is a mill in which artificial humidity is used?—Yes.

1156. What is the system of humidifying?—It is Hall & Kay's, Ashton-under-Lyne.

1157. Have you worked both in dry sheds and humidifying sheds?—I worked in ——— shed fifteen years, and since the Northrops came they have put this humidifier in. There was none in before.

1158. (*Mr. Shackleton.*) That is about five years ago?—Yes, five years last September.

1159. (*Chairman.*) Then you have five years' experience of working in a humid shed?—Since the Northrops were put in.

1160. (*Mr. Higson.*) Was it dry before?—They have always been dry—no steam blowing off anywhere.

1161. (*Chairman.*) Only warming pipes?—Yes, they went straight across.

1162. First of all from the manufacturing point of view: do you consider that the weaving has been improved since it has been put in, or otherwise?—I think it has been improved.

1163. Are you working on the same class of goods as you were before?—Yes, exactly.

1164. Are you able to say whether the output has been greater since the humidity was introduced?—You see, it is Northrop looms now. I cannot say.

1165. (*Mr. Shackleton.*) There is no comparison?—I do think it makes them weave better since they put them in than they did before they put them in. They were not put in just when the Northrops came, but soon after.

1166. (*Chairman.*) Do you spend the greater portion of your time in the shed?—I am very seldom out.

1167. In working hours?—Yes.

1168. Speaking for yourself first, have you suffered any discomfort at any time from humidity?—No.

1169. Have you found any difference in your health. First of all, in your comfort: is there any difference between before the humidity was introduced and after it was introduced?—No, I do not think so. I have always enjoyed good health, and I have worked in the factory for thirty years and over.

1170. We may take it you have not suffered discomfort or ill-health in any way that you can attribute to humidity?—No, not to my knowledge.

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Mr. S— B—

1171. You perhaps are in a position to hear the views of the workers. Have you heard them at any time complain of the humidity—of any discomfort caused by it?—No, I cannot say that, but sometimes I have gone and checked it a little. If it is getting rather warm you can regulate it. You have a certain thing to go by—the hygrometer—and you are bound to keep it about a certain place; if you get it over you are fineable. You are bound to keep it down.

1172. Putting aside for the moment the question of the fine or what the law requires, do you think if you exceeded the limits the people would suffer in health or suffer bodily discomfort?—No. There is very seldom anybody off ill. There are only two off at present that I am aware of—one stopped off yesterday—and at other mills in the district there are a lot off. Some have looms stopped, but we have none.

1173. (Mr. Cross.) The influenza epidemic?—Illness amongst them—colds and what not.

1174. (Chairman.) In the Northrop sheds there are, of course, very few workers as compared with other sheds?—We have 56 on 400 looms; that is including weavers, spare hands, overlookers, oilers, and cop carriers.

1175. (Mr. Cross.) Fifty-six for 400 looms, including yourself?—Yes.

1176. (Chairman.) I think we might reasonably suppose the air would be purer where there are fewer workers. There would be less impurities given off from breathing, from perspiration, and so on?—I cannot answer for those that blow steam in out of pipes, because I have never had any experience of them, but as far as our humidifier goes, I think it is better, because we can throw pure air in. You draw it in. There are two large fans at the top.

1177. Pumping it in?—You can draw it in and there is a lot of ventilation at the top, and this air goes over some asbestos and then passes over water, then up the side, and just up and down the shed. You can draw a large amount of cold air in—pure air.

1178. Have you personally ever felt any dampness or moisture on your clothing which you would attribute to the moisture in the mill?—Very little. We sweat in the mills as we always do. I daresay it helps to do it a little because the air is not that dry to suck it up.

1179. (Mr. Cross.) What has been your experience in summer time. Have you felt that you would like to be outside?—We keep that flap out and get all the cold air in that we can. We keep it in full swing.

1180. It does not trouble you, then?—No; I think it would be warmer without it.

1181. You said there were 56 people all told. You would have had 120 before, would not you. It was three looms to a weaver usually before?—Yes.

1182. That would be nearly 140?—Yes, three looms to a weaver.

1183. You have 80 or 90 people less now in the same area of the shed. Is that so?—You can work that out.

1184. You have not worked in any steaming shed before this?—No.

1185. It was always dry?—Always dry.

1186. So your constitution has been built up on a dry shed?—Yes. I never worked where they had steam blowing off, but I have heard about it. I have heard them say it was a nuisance where steam was blowing off, but I have never been in.

1187. You have heard people say that who worked at other mills?—Yes, but from my own experience I cannot answer.

1188. You never worked in a shed where there was steam?—No, only warming pipes.

1189. (Mr. Roberts.) Would you like this humidifying apparatus to be stopped?—I do not know that I would.

1190. Why?—I think it is better with it.

1191. Better in what way?—Because a weaving shed naturally weaves better when it is a little bit moist than it does when it is proper dry.

1192. And you prefer it to be working on account of the weaving?—Yes, it is better.

1193. But if it was stopped, would not you be better in health?—I do not think I suffer any with it.

1194. Then you cannot be better because you have not suffered?—I do not know that anybody else has. I never heard.

1195. You have never heard any of your weavers complain in any way about this humidifying?—No.

1196. (Professor Lorrain Smith.) What temperature did you stop at when you regulated it?—We generally give about five difference, as close to that as possible. Sometimes it is more than five difference.

1197. What are the readings of the bulbs?—66 and 61. Sometimes it is up as high as 70 dry bulb and the other is low in proportion.

1198. Have you tried to prevent it going above 70?—Yes—getting above 70, that is too big.

1199. Why?—I think it is high enough—70.

1200. (Mr. Higson.) What height does your dry bulb go in hot weather?—I do not know that. I have seen it about 80 on a hot summer's day. I have never seen it above.

1201. And at that time you have been bringing in fresh air whether it has been cool or not?—Yes, it is always sending fresh air in in summer time, and in winter it is sending it in, though not quite to the same extent, because it is very cold.

1202. (Mr. Shackleton.) You said you had 10 years in this same shed before, under what is called the dry shed system?—Yes.

1203. I take it that the weaving was satisfactory then?—Yes, I had no complaint about it.

1204. Your place makes pure goods entirely?—They do not put more size on than is necessary to carry it through. There is not any heavy size put on.

1205. And you use ring twist mainly now?—Yes.

1206. All ring twist now?—Yes, I believe it is now.

1207. (Mr. Higson.) It is all ring twist, I know?—I believe they put all ring twist in a few years ago. They have kept putting them in and throwing jennies out by degrees—and new weft, cop weft.

1208. (Mr. Shackleton.) In that shed, but not all through?—It is in our sheds. The other sheds have what they call bobbins. I have nothing to do with that.

1209. Supposing you did away with steam, and went under the old conditions having a dry shed with your ring twist as against the old mule twist, do you think you could manage without steam?—I do not think it would weave as well, because at — Mill, where I worked before—I do not know whether you know it, it is up at — in Derbyshire, and it was before I came down to — it was rather damp, the same as it is in some weaving sheds. Well, it was not a shed; it was a cellar. That was rather damp, and it smelt a bit musty, but still it worked well with being damp.

1210. That would be the mule twist?—Yes.

1211. I am asking you now whether you think this ring twist which you are working with to-day would weave all right without steam?—I do not think it would weave as well, because you want a little bit of moisture to help it through.

1212. Have you any idea what your breakages are?—It weaves well. I do not think there is a mill in — weaves any better.

1213. What is your minding?—12 looms.

1214. With cop weft?—Cop weft, 12 and 10.

1215. Ten narrows?—10 mixed and 10 narrow.

1216. (Mr. Higson.) Have you noticed any difference in the dust. It was a perfectly dry shed up to five years ago. Is there as much dust now as there was then?—No, I do not think so—not in my opinion. I believe if there was not this humidifier there would be a lot more dust on account of the healds.

1217. (Chairman.) What do you consider the ideal condition for the weaving of the class of goods that

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you manufacture—what temperature and what humidity, what height of the bulbs?—I should say about 66 or 68 is just nice.

1218. 66 dry?—Yes, or 68. You can work comfortably in that, and I do not like to get it any higher.

1219. (*Mr. Higson.*) Have you charge of this humidifier?—Yes. Well, it is there, and I can turn it on or turn it off.

1220. (*Mr. Shackleton.*) 68 dry and 5 down, he said before.

1221. (*Chairman.*) 68 dry and 5 down, that would be 63?—The wet bulb down because when you get within a certain degree you are fineable. If it gets too far you are uncomfortable. That would be the effect.

1222. (*Mr. Roberts.*) I would like to ask you what counts of twist you use?—We have a wide range from 8 to 32.

1223. And you never get any finer?—No, and very seldom up to 32.

1224. (*Chairman.*) You know, I daresay, why we are here. We are here to consider the question of humidity, from the point of view of the health and comfort of the workers and so on. Is there anything

you would like to say?—I have nothing further to add. I have never seen anything to complain of in any way that I am aware of, and I have never heard of anybody else. Very few from the shed are off ill.

1225. (*Professor Lorrain Smith.*) You know that there has been a great objection made by weavers to humidity?—There might be to some kinds; I do not know that there has been to this from what I can gather. It is quite different to this steam blowing off in sheds where these heavy-sized goods are. I have heard a lot about it down in Lancashire, in the "Cotton Factory Times" and other papers—about steam blowing off, and it making their clothes damp and the looms rusty. We have none of that yonder. You can come in and look at the loom shed anywhere.

1226. (*Mr. Cross.*) Would you like to work in steam like that?—I do not know that I would. I am quite satisfied with what I have got. I do not know that I should like the steam blowing off over my head.

1227. You would not like that?—No, it would be very unpleasant, I should think. That would be quite different. If you come in the shed you will not see a lot of rust about the looms.

1228. (*Mr. Shackleton.*) If you keep five down you will never find much rust?—We keep it low enough.

The witness withdrew.

Miss C—F— called in, and examined.

1229. (*Chairman.*) Are you a weaver?—Yes.

1230. Have you been a weaver very long?—About seven years.

1231. Have you always worked in the same place?—No, I have worked at ——— about four years.

1232. ———. That is where you are working now?—Yes.

1233. Before that?— ——— Mill, ———.

1234. Before that?—I was not working anywhere before that.

1235. At the first place that you worked in was there any steam or any artificial humidity?—Well, just the ordinary steam pipes that they used to warm the shed with. That was all there.

1236. Was there any steam jet sending the steam into the shed?—No.

1237. Only just the warming pipes?—Yes, that is all.

1238. Where you are now are there any steam jets or any humidity let into the shed?—Yes, there is a humidifier.

1239. Your mill is the same as that of the previous witness. Will you tell us, please, if the humidity or the steam that comes in ever makes you feel uncomfortable?—Well, not me it does not; I have not felt any difference from it, but, of course, some of them have.

1240. You, personally, have not felt any inconvenience from it?—No, it does not make any difference to me.

1241. But you say that some other people do suffer from it?—Yes, there are a lot of them have influenza, and they do not seem to think it is good for them. They seem to think it is the steam that does it.

1242. But so far as you are concerned you do not suffer any inconvenience when you are working?—No.

1243. In the very hot days in summer is it very much hotter in the shed than outside?—Sometimes it gets very hot, and then we tell Mr. Barber, and he turns it off.

1244. The man who has been in before is your tackler?—Yes.

1245. (*Mr. Shackleton.*) I take it she means turning the steam off and the fresh air would come in?

(*Witness.*) Yes.

1246. (*Chairman.*) Turning the steam off, not the fresh air?—No, just the steam.

1247. (*Mr. Shackleton.*) How far away do you work from this humidifier that you have?—I work as far away as any of them can do where I am now. I have one that goes to the end of the looms, but it is nowhere near the place where all the steam comes from at the beginning.

1248. (*Mr. Roberts.*) It blows in at that part?—Yes; it comes in there, and I think sometimes it must be turned on too much. The water drops then and it makes the floor damp. It does that up and down the shed.

1249. (*Mr. Shackleton.*) At the outlets.

1250. (*Mr. Roberts.*) But it has never made you ill?—No, it is not much that does. I can stand anything. I have not lost a day yet from being ill. I do not think it makes much difference to me.

1251. (*Professor Lorrain Smith.*) At what time of the year do they complain of the humidity?—It is mostly the same all the year round, I think.

1252. But you said it gave them influenza?—There is a lot of them have it now.

1253. Just now?—Yes.

1254. Do they complain in winter as much as in summer, or more?—I do not know about that, I am sure.

1255. You have not noticed any difference?—No.

1256. They do not complain specially in the hot weather?—No.

1257. (*Mr. Roberts.*) I suppose you have many friends who do not work at this mill?—Yes.

1258. But they work at other mills?—Yes.

1259. At these other mills I suppose they are off ill with influenza at the present time, are they not?—I think there is a lot off ill anywhere just at present, but I do not think they are like this we have yonder—from what they say.

1260. (*Mr. Cross.*) Do you ever feel any chill from them?—Sometimes it feels a bit damp.

1261. Which would you rather have—the ordinary warming pipes, such as you had before, or the present system?—I think it was better before. Of course, it helps the weaving.

1262. Is it not so comfortable as before?—No, I do not think so.

1263. (*Mr. Roberts.*) Would you prefer to have it stopped and have it worse for weaving?—I do not know about that. As far as myself goes, it does not make any difference.

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Miss C— F—

1264. You would prefer to have them going for better weaving—the weaving as you have it now?—I think it went almost as well before as it does now, with just the ordinary pipes in.

1265. (*Chairman.*) In the summer are you cooler with the present system than you were under the old system?—No, I do not think so. You see I did not work yonder many months before they put those pipes in and I can scarcely say what it was.

The witness withdrew.

Miss C— H—, called in and examined.

1271. (*Chairman.*) Are you a weaver?—Yes.

1272. Where do you work?—At ———.

1273. (*Mr. Shackleton.*) Which shed?— ———.

1274. (*Chairman.*) Do you work in a dry shed or a humidified shed?—A dry shed.

1275. Have you ever worked in a wet shed?—No, I have never seen one.

1276. Then you cannot tell us much about the effect of the wet. You can tell us nothing about wet sheds except what you have heard?—Only what other people say—that they are not nice to work in.

1277. But in the dry shed where you work, are the same class of goods made as in the wet sheds in the same mill. Do you know whether it is the same kind of goods?—The same kind of work?

1278. Yes?—It is not the same kind as at some of the places; it is better stuff.

1279. (*Mr. Shackleton.*) Is it similar to ——— Mill?—Yes, it is something similar.

1280. (*Mr. Roberts.*) But you do not use the same kind of twist?—I think they use the same stuff, only theirs is Northrops and ours is not Northrops.

1281. Yours is the ordinary loom?—Yes.

1282. (*Chairman.*) Do you find any difficulty in weaving without any humidity? Do you find that you can get on with your weaving very well without any steam or any moisture?—We get on very well without steam.

1283. (*Mr. Shackleton.*) What number of looms have you?—Four.

1284. (*Chairman.*) They are the ordinary looms?—Four ordinary looms; yes.

1285. (*Mr. Shackleton.*) What do you earn from them?—About 29s. or 30s., and so on.

1286. (*Mr. Higson.*) Are they wide looms?—36 in. There are different sorts in our works, mine is 36.

1287. (*Mr. Cross.*) Do you say 29s. or 30s. every week?—Yes.

1288. Full work?—Yes.

1289. (*Chairman.*) Is there any particular kind of ventilation in your shed?—Yes, there is plenty of ventilation.

1290. What sort of ventilators are they?—There are some like slats on one side where I am working. There are slats, and we can open them and close them when we mind, and there is a ventilator over the top, at the side of the windows. Then they put

1266. You cannot remember very well?—No.

1267. (*Mr. Higson.*) When you worked at ——— Mill had they any steam blowing there?—No.

1268. Did they warm it with pipes?—Just the ordinary warming pipes.

1269. You had no steam blowing off?—No.

1270. (*Chairman.*) How many looms do you mind?—Twelve.

little boards up in winter time, but they do not keep them fast.

1291. Is there any mechanical ventilation. By mechanical ventilation I mean sent in by fans?—No fans.

1292. In summer does the shed get very hot?—It is hot in summer.

1293. Of course on some days in summer it is hot everywhere, but comparing the outside atmosphere and the inside atmosphere which is the worst on a hot day in summer—inside the mill, or outside the mill?—Sometimes it feels cooler inside than out. There is no sun gets in. You see the windows are put the other way, so that the sun will not get in.

1294. Have you ever been in a humid shed in the same mill?—No. I have never been in one.

1295. Not in the same mill?—No, not in the same mill.

1296. There is one in the mill in which you work, is not there?—It is a different place.

1297. (*Chairman.*) About the dust. Is there much dust flying about?—No, there is very little dust in ours—not that much.

1288a. You do not suffer any inconvenience from it. When you get home do you find any in your throat as if you wanted to cough it up?—No, it is not that sort that they do ours with. It is a different kind of stuff.

1289a. (*Mr. Shackleton.*) A different kind of size?—Yes, that is it.

1290a. How long have you worked at this mill?—Over 30 years.

1291a. (*Mr. Higson.*) You have had good health all the time, have you?—Yes, I am very seldom off.

1292a. Are there any weavers off ill from this shed that you know of now?—There are plenty up and down now with influenza.

1293a. (*Mr. Roberts.*) Are there plenty out of this shed?—They are just coming back now. There have been plenty of them.

1294a. (*Professor Lorraine Smith.*) In the hot summer weather, when it is hot outside, do you find much discomfort. Are you uncomfortable?—Yes.

1295a. Is it very uncomfortable in the shed to work?—It is uncomfortable of course, but it is warmer outside than in.

1296a. It is quite easy to go on working?—Yes.

1297a. And you have nothing to complain of?—No; we have nothing to complain of.

The witness withdrew.

Mrs. M— F—, called in and examined.

1298. Are you a weaver?—Yes.

1299. How long have you been a weaver?—22 years.

1300. Have you worked all the time in one mill, or in several mills?—I have worked in several mills.

1301. Have you always worked in humid sheds?—No.

1302. Would you mind telling us what sheds you have worked in—the names of the firms?

1303. (*Mr. Shackleton.*) How long have you been at the present one?—It is only newly built. I have only been there two months. That is the ——— Company at ———.

1304. (*Chairman.*) Would you tell us the other sheds you have worked in, and how long you worked in them?—The first one I worked in was Mr. ———'s in ———, ——— Mill. Then Mr. ———'s.

1305. Is that a humid shed?—No, there is no steam there.

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1306. Only heating pipes, I suppose?—I do not know that there were any heating pipes. It was cold enough. It made no difference.

1307. After that where did you work, and how long?—The ——— Mills.

1308. For how long?—I worked there about seven years.

1309. That brings us up to what date?—Up to about two years since.

1310. Was the mill that you worked in for seven years a humid mill?— ——— Mills?

1311. Yes?—Well, there was steam, but there was not much, because they were Jacquards and they could not put it in.

1312. There was not much steam?—No.

1313. (*Mr. Higson.*) Fine goods?—Yes. You see some of the looms were worked with cards and it would soften them, and they could not put it in.

1314. (*Chairman.*) After that mill where did you work?—I was working in Preston about two years, and I have gone back to ———.

1315. Where did you work at Preston?— ——— Mill was the real name.

1316. (*Mr. Higson.*) There were Jacquards there?—There was no steam where I was. It was a little place.

1317. (*Chairman.*) That brings us up to where you are working now, the ——— Company?—Yes.

1318. There there is steam, I understand?—No, it is not steam.

1319. What is it?—I could not tell you.

1320. There is humidity introduced?—Yes.

1321. Through pipes?—No, it is not pipes.

1322. (*Mr. Roberts.*) It is the Vortex Spray.

1323. (*Chairman.*) It is sprayed there. It does come through pipes, but it is not distributed through pipes. You have worked in places where there is no steam?—Yes.

1324. Where there is very little steam, and now where there is water sprayed?—Yes.

1325. So far as your comfort is concerned, which system do you think the most comfortable?—Without.

1326. Without any?—Yes. I do not know that this makes any difference. It does not seem to make any difference now—what they have there.

1327. Where you are now?—Well, it has not made any difference with me.

1328. That is the water spray system?—Yes.

1329. Which do you think is the most comfortable, the water spray or the steam?—I could not work under steam. I once went to a place and worked there about a week, but I had to give over. I could not work when I was there.

1330. You could not work where there was steam?—No.

1331. How did it affect you?—I could not eat anything.

1332. It took away your appetite?—Yes.

1333. Did you feel as if you had not got the usual

strength and energy?—I had not. I could not stay. I had to leave.

1334. And you think that was due to the steam?—Yes, it was. I could not work under steam at all.

1335. Did I understand you rightly to say that where you work now you do not suffer inconvenience?—I have only been there two months, and I cannot tell you yet, but it has made no difference so far.

1336. Do you feel comfortable in the shed?—Yes.

1337. (*Professor Lorrain Smith.*) What time of the year was it when you tried to work under steam?—I could not tell you. It is about 10 years since.

1338. (*Mr. Higson.*) What sort of stuff were they working where they had steam in. What sort of goods were you making?—It was plain work—cotton.

1339. But were they cambrics or shirtings?—I have forgotten.

1340. (*Mr. Shackleton.*) Do you remember what mill it was?—Yes. I do not know whether there is any difference made now. It might be different.

1341. What mill was it?—It was the ——— Mills.

1342. At ———?—Yes. But, you know, it might be different altogether now.

1343. (*Mr. Higson.*) Do you enjoy good health as a rule?—Yes.

1344. You are not troubled with chest complaints, such as coughs?—No.

1345. Asthma?—Yes, I am troubled with asthma.

1346. (*Professor Lorrain Smith.*) How long have you had the asthma?—I could not say. We all have it in our family.

1347. (*Mr. Higson.*) Are all your family weavers? For instance, was your father a weaver or tackler?—No.

1348. Your mother?—No.

1349. Then you would not think the asthma in your family was contracted in mills?—No, they were country people.

1350. (*Chairman.*) Do you think that the humidity keeps the dust down at all—that there is less dust where they have artificial humidity?—There is no dust there. There is just some dust on the looms after Saturday, but there does not seem to be any from the cloth. When we are pulling cloth out it does not fly.

1351. (*Mr. Roberts.*) That is at your present place? Yes.

1352. Where you have artificial humidity?—Yes.

1353. When you have worked at a place where there was no steam and no water spray, did you experience any difficulty from dust?—No.

1354. It did not affect your breathing at all?—No.

1355. (*Professor Lorrain Smith.*) Do many weavers have asthma?—I do not know. I could not say. My mother never worked in a shed, and she has asthma.

1356. But do many who work in sheds have asthma?—I could not say.

1357. (*Mr. Cross.*) At this mill or at any you have worked at that you have known of?—No.

The witness withdrew.

Mr. W— R— called in, and examined.

1358. (*Chairman.*) Are you a weaver?—Yes.

1359. Where do you work?—I am working at ——— just at present, at the new shed.

1360. How long have you worked there?—I have only been on a month.

(*Mr. Higson.*) That is at the ——— Company's, the same as the last witness.

1361. (*Chairman.*) Where did you work before that?—At ———.

1362. In what mill?— ——— shed.

1363. And how long did you work in that mill?—Three years when yonder gaffers took it.

1364. Is there any steaming in that ——— mill?—Yes.

1365. What system?—It is too bad, because I could fish at the back of my looms. I am not telling you lies. I am telling you the truth. I did think of taking some fish and putting them in. I had to come off last year; I was off nine months with rheumatics.

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Mr. W— R—.

1366. What sort of system did they use to send the steam in?—It throws it against the top of the shed, and then they have put tins round to catch it dropping off the looms, and it drops on the floor.

1367. Is it live steam or is it water?—It is water. It throws it on the top. Then you know it drops. It dropped on the beams, so they put some tins in—the same as these galvanised tins, like those—to keep it from dropping on the beams. It drops on the floor. At the back of my looms I could have fished if I had put some fish in. I am not telling a lie; I am telling the truth.

1368. (*Mr. Roberts.*) Is this ——— shed?—Yes.

1369. Is not it Howarth's system of humidifying?—I do not know whose system it is.

1370. (*Chairman.*) Did you suffer in health, on account of this moisture?—I had to go under the doctor. I went under him last Christmas but one, and he came to give me a bottle of medicine 15 times. He said it was rheumatics, and it was getting to my kidneys. I have paid more for doctor's bills than what I was getting for working.

1371. You got a bit of fishing sometimes?—I could have had, if I had taken them and put them in.

1372. At any rate, you are quite satisfied that the moisture did you harm?—It did me harm. I can tell you another place, independent of that, that I have been to. They used to put a sack of cloth when we were sweeping, for the damp striking through.

1373. (*Mr. Roberts.*) Which place is that?— ——— Mill. If you went in during the day you could not see for the steam.

1374. (*Mr. Shackleton.*) Who is the manager?—To tell you the truth, I do not know who is now, because the other one, there was some bother with him.

1375. (*Mr. Higson.*) Have you worked at ———?—I worked there a week and three days, and had to come off with rheumatics.

1376. Mr. ——— is now the principal there?—I believe that is it, but he is not there now.

(*Mr. Higson.*) He is there now.

1377. (*Chairman.*) Where are you working now?—Yon new shed at ———.

(*Mr. Shackleton.*) It is the same as the one the last witness came from.

(*Chairman.*) It is the ordinary looms.

(*Mr. Roberts.*) Yes, the ordinary looms.

1378. (*Chairman.*) What about the place you are working in now?—For what I can see, if they will stick to what they are, it is right at present, because it is dry on the floor. When everything under your feet is dry, you have a better chance than when you are down in water.

1379. How long have you worked there?—A month.

1380. Have you suffered any discomfort there?—I have been very well satisfied. I am going to stop if they will let me.

1381. You are well satisfied where you are now?—I am.

1382. And you do not think that the moisture that is introduced now is doing you any harm?—I have

had better health since I went than I have had for a good while. I am not telling you lies; I am telling you the truth when I do speak.

1383. Do you know anything about what they call live steam—letting steam in through jets right into the shed. Have you ever heard anything about that?—Blowing it in—that live steam. When I was a young fellow, about 15 years old, we used to have red-hot weights to warm our hands with, and it was weaved then; it did not need any of this work. Now it is all rheumatics and such like at the Infirmary. We used to warm our hands, and then run off to the looms and begin weaving, and it was weaved then; and now they put stuff in which brings on the rheumatics and they go to the Infirmary.

1384. (*Mr. Shackleton.*) Have you worked in any dry sheds?—Yes, the ——— Mill, ———.

1385. How long were you there?—Nineteen years.

1386. Did you suffer from rheumatics then?—No, I was very well satisfied; Eldon Street is a very good place.

1387. How long have you worked at the other mill you have just mentioned?— ——— Street. I worked from Easter to Whitsuntide.

1388. (*Chairman.*) Could you weave as well in the places where you had no steam?—Yes.

1389. Did you get as good money?—Yes.

1390. The same money?—Yes.

1390a. What class of goods were you working on?—I have worked all sorts; on fancy work, and also on Jacquards.

1391. Was that heavy sizing or light sizing?—It had to be light for fancy work. You know when you are going to use China clay and that you have to have something to make it do.

1392. Have you ever worked on heavy-sized goods without any steaming?—I have not—velvet and such like as these, heavy pick goods.

1393. When you worked in a dry shed it has been on lightly sized goods?—Yes, when I have been agate with fancy work.

1394. You say you would make as much money in the dry sheds as in the humid sheds?—Of course, I would have made more if I had had sense. The same as a lot more; I liked to enjoy myself.

1395. The weaving was as good?—Yes. If they would put proper stuff in, and do away with steam, as they ought to do, folk could have some pleasure, instead of going to the Infirmary, but they are cut off now. When they are 30 years old they are cut off with rheumatics and such like, through dampness. Fancy going and hanging your coat and waistcoat up in these places, and then, when you come to put them on, on a foul winter's night, they are wet through with steam. You feel nice when you are going home, with that drying into you. Where do your rheumatics and sciatica come in then? I know. I have been at it 40 odd years. I am only thinking of the grandchildren. It is they who have to be looked to. It is not me who has to be looked to; it is the children who have to come after us who have to be looked to.

The witness withdrew.

Mrs. A— B— called in, and examined.

1396. (*Chairman.*) Are you a weaver?—Yes.

1397. Where do you work?— ——— Mill, ———.

1398. How long have you worked there?—About six years.

1399. There is artificial humidity in that mill?—Yes.

1400. How is it let in; is it steam or what?—It is steam.

1401. Perhaps you are not able to tell us the particular system that is adopted?—No, I cannot.

1402. (*Mr. Shackleton.*) Have you long pipes running down?—There is a long pipe and there are holes.

1403. (*Chairman.*) What class of goods do you work upon?—Plain work.

1404. (*Mr. Higson.*) Fine goods?—Yes.

1405. (*Chairman.*) Light size or pure, would it be? Perhaps you do not know. Perhaps you do not go in the sizing room and you do not know how much size is put on?—No. We know the width.

1406. By size I mean the clay and stuff they put on?—I do not know that.

Mrs. A— B—

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(Mr. Cross.) They are fine goods.

(Mr. Roberts.) It would be light sizing.

1407. (Chairman.) You have worked in that shed for how long?—About six years.

1408. Have you, generally speaking, been healthy?—I was healthy before I went to working near the steam-pipe, but when I had been working there a tidy bit I was hoarse for about three weeks. I had never been off before I went there. I had never been before with a cold.

1409. You have been hoarse?—Yes, after that I have been kept bothering with colds one after another.

1410. In summer and winter?—Yes.

1411. Have you got something in your throat—is that it?—My chest and my throat. Sometimes after about half-past four we have not patience to work for our legs being aching with the floors being damp and wet. Our clothes sometimes, if we hang them at the back of the beam on a pole, are that damp that we cannot put our neck shawls on through them being so damp.

1412. Is there any cloak room?—There is no cloak room whatever. There is just a pole.

1413. Where do you hang up the clothes?—There is a pole at the back of the beams.

1414. (Mr. Shackleton.) You mean a pillar?—Yes.

1415. (Mr. Higson.) You hang your clothes upon a hook which is on this pillar?—Yes.

1416. (Chairman.) That is in the shed?—Yes.

1417. (Mr. Higson.) And the pillar gets wet?—Yes.

1418. (Chairman.) You attribute this hoarseness, you say, to humidity in the shed?—I think it is the steam that does it.

1419. Apart from the question of health, do you feel any inconvenience from it? Does it make you feel cold? You told us that it did just now. You said the floor gets damp, is that it?—Yes.

1420. It makes you feel uncomfortable?—Yes.

1421. You have never worked in any shed without steam, I suppose—without moisture?—No, I have not.

1422. (Mr. Cross.) You have always worked in a steam shed?—Yes.

1423. (Chairman.) Do the clothes that you wear—I do not mean the clothes which you hang up—get damp?—If we take our neck shawls off our necks and put them in our weft tins we cannot put them on again; we have to carry them on our arms because they are so damp.

1424. And your body clothes. Does the clothing about your body get wet?—I have not taken any notice, only I know our neck shawls are damp. Where I work the water is always coming out of the steam pipe and it is just the same as if it is spitting and raining.

1425. Perhaps you work in a blouse or a jacket, do you?—Yes, in a blouse.

1426. Does the blouse feel wet when you get home?—I never took any notice.

1427. You have never noticed in particular that it was wet?—No.

1428. And you say the clothes you hang up get wet?—Yes.

1428a. (Mr. Roberts.) But they get wet really from contact with this pillar—on account of the pillar getting wet, you said?

1429. (Professor Lorrain Smith.) Is it the same every day?—It is Mondays and Tuesdays they are awfully wet—the floors and things being damp.

1430. Not the rest of the week?—About Friday it is very dry.

1431. (Chairman.) Have you ever discussed this question with the other weavers in your shed. Do you

ever talk about this moisture?—Yes, there has been a lot of bother over it, and there are a lot of weavers off with the rheumatics, and they blame it on nothing but the steam.

1432. You say “bother.” What form did the bother take?—Rheumatics in their legs.

1433. (Mr. Shackleton.) You mean by bother that they talked about it?—Talked about it, yes.

1434. (Mr. Roberts.) Have they gone up to the masters about it?—They have been up several times, but they have done nothing for it.

1435. (Mr. Cross.) Are there many weavers off now?—There are a lot of weavers off. The girls have, between 17 and 21.

1436. Did you ever work anywhere else besides here?—I worked at — Mill about a month. I was under tenter.

1437. (Mr. Roberts.) You have only worked here as a weaver?—Yes.

1438. (Mr. Cross.) How is the place in summer time? Does it trouble you much?—It is just the same for being damp.

1439. Is it very hot?—Sometimes it is very hot, sometimes it is not.

1440. (Mr. Higson.) You say that near your looms there is one of these openings and water comes out just as if it was spitting and raining?—Spitting and raining all the day.

1441. Would your floor be damp, supposing this water was not spitting out of this hole?—I noticed yesterday morning it was not spitting, but the floors were wet just the same. But it is like that all the day over near me—spitting out of the pipe.

1442. Too much water amongst it?—Yes.

1443. That is not steam, is it. It is water?—Yes.

1444. (Mr. Roberts.) Is there anything peculiar about this handkerchief which you hang about your neck. Is it silk?—No, it is just cotton.

1445. You put it into your weft can, you said?—Yes.

1446. Does the water drop on to that weft can?—No, it does not drop on the weft can, but it leaves it damp.

1447. (Chairman.) You have never worked in a dry shed, I think you told us?—No.

1448. So you are not able to say, from a manufacturing point of view, whether the weaving is better in the dry shed or in the wet shed?—No, I cannot.

1449. (Mr. Roberts.) In your experience of this place have you ever had to stop this humidifier for anything?—No, I do not think so.

1450. It has not been stopped in your time?—No, but then it has not been in all the time I have been working there. It has only been about four years.

1451. Does it make it weave any better?—I think they are fetching worse yarn in since they got that, and they could not manage without it.

1452. (Mr. Cross.) What happened before this?—They had steam pipes.

1453. (Mr. Roberts.) Had they little jets coming in like this (indicating)?—Yes.

1454. (Mr. Shackleton.) You have always had steam?—Yes. The floors were not as damp when we had that other system.

1455. (Mr. Higson.) Is this system wetter than the other?—Yes.

1456. (Mr. Roberts.) So you would prefer to go back to the steam—to these small jets?—Yes.

1457. You did not experience any wetness from that?—I do not remember about dampness. There was not as much complaint then as there is now.

The witness withdrew.

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Miss S—— G—— called in, and examined.

1458. (*Chairman.*) Are you a weaver?—Yes.

1459. Where do you work?— Company.

1460. The same mill as the last witness worked at?—Yes.

1461. How long have you worked there?—About 10 or 11 years.

1462. The last witness told us that in former years you had moisture introduced by steam jets, and that now there is another system?—Yes, there is.

1463. Which system do you think the best?—The one that we had before.

1464. Will you tell us why?—The dampness that comes out—the steam which damps our clothing. It seems to rise up in the shed and then drop down and cause the floor to be wet, and it must damp our clothing.

1465. Does this dampness cause you any inconvenience or discomfort?—Yes, there is a deal of sickness at times, with cold and rheumatism.

1466. There is inconvenience and, you say, sickness too?—Yes, I think it is against our health.

1467. Have you personally suffered in health at all? Yes, I have been off ever so many times with colds and bad throat.

1468. I suppose you have never worked in a dry shed altogether. By "dry shed" I mean any shed where there is no artificial humidity?—No, I cannot say that I have, but ours is worse than others. Sometimes the floor is black wet with damp, and we have to put paper on the floor while we go under them to sweep our looms.

1469. You are clearly of opinion that this moisture is causing discomfort and bad health?—Yes, I do think so.

1470. Would you wish to see it stopped altogether?—Well, there is this about it. If it is stopped it is against our work. It moistens the yarn. The work would be worse. But then if it is against our health they must get better twist.

1471. Then I gather that you would not wish to see it stopped altogether?—If we had good yarn it would make all the difference.

1472. But supposing you were to work with your present yarn, would you wish to see it stopped or not?—I should myself.

1473. You would like to see it stopped?—Yes, the humidifiers that we have in.

1474. Suppose that instead of being stopped it were arranged in such a way that it would produce a reasonable amount of humidity and not wet the floor and wet your clothes. Would that be better than stopping it altogether?—Yes, I think it would myself in that respect.

1475. You think that if it could be arranged?—It could be better than it is.

1476. It could be better arranged than it is?—Yes.

1477. Both for weaving and for health?—Yes.

1478. (*Mr. Higson.*) You remember when they had the steam jets blowing before they put this apparatus in?—Yes.

1479. Was there any objection to the steam blowing. Did you find the floor damp then. Was that inconvenient?—It was bad at times, but nothing the same as it is now.

1480. But you did not object to the steam like you object to this?—Well, we objected to it in this way. Sometimes they had more on than at others.

1481. (*Mr. Cross.*) You always objected to it then?—When it is what we call blowing off to such an extent it causes a deal of dampness. Then they take it out at times and then they put it in again.1482. (*Mr. Roberts.*) You do not object to it if it is put in in reason?—No, not in reason. I cannot be healthy the way that it is now by a long way.1483. (*Professor Lorrain Smith.*) Are there many weavers off now through ill-health?—I could not say—not at the present time.

1484. Do you know of any case or cases of illness within your own knowledge—the names?—No, I could not say. Of course, there are weavers off many a time that we do not know.

1485. (*Mr. Higson.*) I suppose these are fine goods, fine twist and weft, that you weave here?—Yes.1486. (*Professor Lorrain Smith.*) Does it get dry in the shed at the end of the week?—I do not know whether you were one of the gentlemen who came in, but on that day it was dry enough; on the Monday and Tuesday the same week the floors were black wet.

1487. What day of the week was it we came in?—I do not know whether it was Thursday or Friday.

1488. It was dry that day, was it?—Yes.

1489. But it is damp at the beginning of the week?—Yes.

1490. Is that quite a regular thing?—It varies. Sometimes we get it very damp in the morning; then perhaps in the afternoon, when they have turned some of the steam out, the floor seems to soon dry. Yesterday it was damp.

1491. It is the same summer and winter?—Yes.

1492. (*Mr. Roberts.*) Did I understand you to say that two days before we were there it was very damp?—On the Monday during the week that you were in—I could not say whether it was Thursday or Friday—the floor was black wet, because all the weavers were making remarks over it being so dry when the gentlemen came in, after what it had been at the beginning of the week.

1493. Yesterday it was an easterly wind, and probably they would put it on a bit. That would account for it yesterday probably. You say it was wet yesterday?—Yes, yesterday afternoon it was wet.

The witness withdrew.

Mrs. M—— J—— B—— called in, and examined.

1494. (*Chairman.*) Are you a weaver?—Yes.

1495. Have you been a weaver for many years?—Yes, ever since I was 10 years old. I was 14 when I got looms of my own, and I am 31 now.

1496. Where are you working now?—

1497. (*Mr. Shackleton.*) Have you been there all the time?—Yes.1498. (*Chairman.*) All the 17 years?—Yes.

1499. Have you had humidity all the time?—No.

1500. When did you first begin to work with humidity?—I should think it is about 12 or 13 years since.

1501. Before that you had no steam and no moisture of any sort?—Only the piping round the shed to heat the place.

1502. Just to heat it, but not to moisten it?—No.

1503. Then you have worked under both systems?—Yes.

1504. Which do you think is the best system for comfort and for health?—The one without the steam.

1505. Which is the best for weaving?—Steaming.

1506. Taking the shed as it is now, the system of letting the steam in is Hart's system. Do you know the name?—No, I do not. I work against one. I know what they are.

Mrs. M—— J—— B——

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1507. Do you think that the steam has caused you any discomfort at your work?—No, I can get a lot more money with it, but I think I have got colds with it.

1508. You get a lot more money, but you have colds?—Yes.

1509. Do your clothes get wet at all. I mean the clothes which you work in, not the clothes which you take off before you go to work?—I cannot say as they are exactly dry.

1510. But do they get moist enough to be uncomfortable?—No, they do not become uncomfortable.

1511. Do you work in a blouse?—Yes.

1512. Do you find that blouse wet and uncomfortable when you get home?—No, only when I am very hot. That is all.

1513. That is in the summer?—Yes.

1514. Would you rather work with the steam or without the steam?—Well, for the work I would rather have the steam, but I do not think I like it for my health.

1515. Would you probably get more money with the steam than without it?—Yes.

1516. I think you said you had worked 17 years?—Yes.

1517. How long have you been ill during that time?—I think I have had once three weeks.

1518. You were away three weeks?—I have been many a week going away.

1518a. You are not reckoning that, are you?—I have had three weeks and a month holidays, but not been ill with it.

1519. You have been away for three weeks or a month taking a holiday, but was that because you were ill?—No.

1520. In the 17 years have you been away from your work at any time on account of illness?—No.

1521. (*Mr. Shackleton.*) I suppose you are one of the women who can afford to have a week or two now and then. You are straight up at home?—Not only that, but I have friends in the Isle of Man.

1522. (*Mr. Cross.*) You said for the work you would prefer steam because you got more money. Years ago you had no steam, only warm pipes. Do you recollect what the difference is between now and then?—I should think five to six shillings.

1523. Were you making similar goods to what you have now?—I think they are about the same.

1524. Did you weave worse then?—They went a lot slower then than they do now.

1525. You have been speeding up since. It is not only the question about the humidification?—No.

1526. (*Mr. Shackleton.*) And in that time you have had 10 per cent. advance in wages?—Yes.

1527. (*Mr. Cross.*) What sort of colds are you troubled with?—In my head.

1528. (*Mr. Higson.*) Influenza colds?—Yes.

1529. (*Mr. Cross.*) I mean by that, are you very much troubled with colds in the head which you attribute to the form of humidification you have now?—You see, there is so much influenza that you cannot say whether it is through this or not.

1530. (*Professor Lorrain Smith.*) Does it get very hot in the summer?—Yes, very.

1531. (*Mr. Roberts.*) You said you worked near one of those machines. Do you feel the draught from it?—No, I do not.

1532. You work so near that if there was a draught you would feel it?—Yes, but the others that work against it say it is only when it is stopped; but I do not stay in to have meals.

(*Mr. Shackleton.*) It is only when it is stopped that the draught comes.

1533. (*Mr. Higson.*) You have never worked anywhere else?—No.

The witness withdrew.

Mr. H—— T—— called in, and examined.

1534. (*Chairman.*) You are a weaver?—Yes.

1535. Where do you work?—Mills, —.

1536. How long have you worked there?—I daresay about 20 or 22 years—something like that.

1537. During the 22 years have you worked all the time in humidified atmosphere?—No, not quite. I was away a few years—for about four years.

1538. What I rather meant was, have they had humidity all the time in the shed?—No, it is not all the time. When I was quite young they had not—when I had just commenced.

1539. Can you remember how long they have had it?—I should think about 12 or 15 years.

1540. All the time on the same system?—No.

1541. What was the first system?—I remember them trying to put in a German patent, but it was taken out very soon. It proved a failure. It was not in long.

1542. After that what did they put in?—Hart's patent, that is in now.

1543. How long have they had it?—I should think, roughly speaking, 12 or 15 years as near as I can recollect.

1544. What sort of health have you enjoyed all this time?—Speaking for myself I have not felt well while I have been working under them. I have been off my work twice, but I do not know whether it is that exactly.

1545. You were off work twice?—Yes.

1546. For how long?—A month at a time. I had got run down in health.

1547. How long is it since?—Just 12 months since.

1548. That is one period. When was the other

period?—I was off in January and February, 12 months ago, and in October previous to that.

1549. Did you consult any doctor?—Yes.

1550. What did he say was the matter with you?—Pleurisy.

1551. Do you attribute your illness to working in a moist atmosphere, or to other causes?—No, not definitely, I cannot say that I do. I had got run down in health. Of course, it was a big change. I had been away from the mill four years, and I had to go back and work in the humidity, and I seemed to feel it very much—the change going back into the shed.

1552. During the four years while you were away, were you employed in an outdoor occupation?—No, I was in a warehouse, cloth-looking.

1553. (*Mr. Higson.*) For the same firm?—No.

1554. (*Chairman.*) Did you feel any discomfort on account of the moisture?—Sometimes. It all depends on the day, as far as I can speak for myself.

1555. On some days you say you do?—Yes. We seem to feel the moisture very much if it is a very close day, but that one I am working under, if it has been like that, and it has been on too much, I have complained and asked the manager if he would turn it off a bit or turn it down, and they have come and looked, and they have turned it down—turned the steam off a little.

1556. (*Professor Lorrain Smith.*) Does the air get all right when they do that?—Yes, it seems pretty fair afterwards.

1557. (*Chairman.*) What is your opinion, generally speaking. Do you think that the workers in the sheds suffer in health, or does their comfort suffer on account of the moisture?—If I must just tell you, I went round and I got the opinions of everyone that

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Mr. H— T—

worked under every one of them. I believe there are 15 in the shed, and I personally went round, and everyone complained. They said it was not beneficial to them. But the main complaint was that they felt a draught, especially when they were stopped—a down draught.

1558. That is when they are stopped?—Yes, just before the engine stops. They turn off about 10 minutes.

1559. The inconvenience was greater when it was stopped that when it was running?—Yes, but they complained, too, while it was working, of the moisture. They said they felt better before they had them.

1560. Would you like to see moisture of every sort removed from a weaving shed?—No. I may say this; that as far as I have found it, it is better for the yarn, but I do not think, speaking for myself, that it is better for us.

1561. You think it is better for manufacturing purposes, but worse for health. Is that what you mean?—Yes.

1562. Do you know anything about any sheds that are not humidified?—No, I do not.

1563. You know, of course, where a shed is humidified, that there is what is called a standard of ventilation?—Yes.

1564. That there must not be more than so many parts of CO₂?—Yes.

1565. Do you realise that that keeps the air fairly pure. Perhaps you cannot compare it with places where they have not that ventilation?—No, I cannot.

1566. You have not had the opportunity of judging?—No.

1567. (*Professor Lorrain Smith.*) Do you say you consulted 15 people?—More than 15. There are 15 machines.

1568. You mean that it was the people who were immediately under the machines?—Exactly under them.

1569. Who were affected?—Yes.

1570. What about the others?—We will say the machines are in the centre of this (*indicating*). The person *here* has the benefit of them. It is only just those who are practically under them or just at the side.

1571. Those who are some distance beyond like them?—They cannot tell, because they do not feel the effects of them at all; it does not reach them practically, although it is supposed to spread. It is us that are right under them that feel it.

1572. How many people would be affected by one machine in that way?—There would be about half a dozen.

1573. Under each machine?—Round.

1574. Near enough?—There would be four looms here, and four looms here (*indicating*).

1575. I mean how many people immediately under the machine would feel the bad effects that you have mentioned?—It would be from four to six.

1576. Is the weaving as good at the looms that are not under the machines as it is at the looms which are under?—No. I do not think it is as good. It would be better under the machine on account of the sizing the warp. It makes it moist.

1577. Assuming that two weavers worked equally hard, one at a loom under the machine and the other at a loom removed some distance from the machine, would they have made the same wages at the end of the week?—Yes, I believe it does affect the yarn all over the shed. The person does not feel the draught from them, but it will affect the yarn I have no doubt.

1578. If it materially affects the yarn one would expect some weavers to get more wages than others, and probably there would be competition for the looms where the best wages were made?—I do not think there is much difference in that.

1579. (*Mr. Shackleton.*) I take it what you mean is this, that the air would be humidified even some distance away?—Yes.

1580. But is it your idea that those working immediately under feel the draught of it or feel it more?—Yes.

1581. You say you have worked at this mill with the exception of four years, for about 20 odd years?—Yes.

1582. You worked at it before they had the humidifier at all?—Yes.

1583. When it was a dry shed, without any steam excepting the heating pipes?—Yes.

1584. What is your impression as to the difference between then and now, from your point of view personally: what do you think yourself?—I started when I was 10 years old. There was no steaming, and I was getting good money; they had no humidifying process, but just the ordinary steam pipe.

1585. Just to heat the shed?—Just to heat the shed.

1586. (*Mr. Higson.*) No steam blowing off?—No steam blowing in, only in the winter we should turn the steam on for getting warmth through to warm it, but we had ventilation then. All the ventilators are up now, but they are all closed up with the exception of a little ventilator put in recently. When they adopted this new humidity system all the ventilation was done away with. If we could have ventilation with humidity I think it would be better.

1587. (*Chairman.*) You get the ventilation through the Hart humidifiers now; you get air in?—We have the ventilation and the steam, too.

1588. You have them mixed?—Yes.

1589. In the old days that Mr. Shackleton referred to did you do any degging?—Yes, it has been done.

1590. You used to deg?—Yes, not so very much.

1591. But on a very dry day with an easterly wind?—Yes. What we adopted was this. If it was a frosty day or a dry day and the atmosphere seemed to be very dry we used to put what they call wet cloths on the beam.

1592. You got moisture that way?—Yes.

1593. (*Mr. Roberts.*) And you occasionally degged the floor?—Yes.

1594. Did you use hot water or cold water when you degged?—I think they used cold water in summer time.

1595. Of course, it is going a long way back?—Yes.

1596. (*Mr. Cross.*) What is your opinion about the weaving in summer time. Do you feel any difficulty in going on with your work?—We will say it is a very hot day. I have no doubt when these machines are turned on as usual it makes it very heavy.

1597. It makes it hot?—It seems to do.

1598. It does not seem any cooler then?—They are supposed to make it cooler, but I have not found it so myself.

1599. (*Mr. Shackleton.*) You do not know whether they are using cold water or not for the machines outside?—No.

1600. You do not know that?—No, I do not.

1601. (*Mr. Higson.*) Do you think it is hotter in the shed than outside in the summer time, too?—No, not always. I have found it cooler in the shed than it has been outside.

1602. (*Mr. Cross.*) Do you know the highest amount of heat you have had by any of those machines put up?—I look up there every day, what is on the machine.

1603. (*Mr. Shackleton.*) That is no indication of the shed?—No, I look at that and I see it is 70 many a time.

1604. (*Mr. Roberts.*) What is the highest you have seen it at?

1605. (*Mr. Cross.*) In summer time?—I recollect one day very particular. I believe it got up to 80, but it was only on one occasion, and it was extremely hot outside. I think it was nearly 80; I remarked about it.

1606. (*Mr. Shackleton.*) That is the one fixed on to the machine?—Yes.

1607. Not the one fixed to the recorder?—No.

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1608. You do not see those?—No, they are not against me.

1609. Do you know whether the weavers are in the habit of looking at those things?—I know that at this mill where I was cut cloth looking, they did. I daresay they will up yonder. I should keep looking.

1610. (*Mr. Cross.*) Was there not steam used when you were there?—Yes, they had humidity there.

1611. (*Mr. Roberts.*) What sort of humidity?—It was steaming, but they had not Hart's machine.

1612. Was it a steam pipe with steam jets to it?—No.

1613. You do not know how it was put in?—No, not exactly.

1614. (*Mr. Cross.*) You never went into the shed?—No, only when on business; that is all.

1615. You did not notice then as to what form it took. Was it a steam pipe with jets?—It is throwing out just the same as ours is through Hart's, only it is a different class of machine.

1616. (*Mr. Higson.*) You said just now that you had been off poorly twice?—Yes.

1617. Does that mean twice in 20 years?—No. I was off in September and October, 12 months back, and then in January and February after that.

1618. What about before?—I have been off with the rheumatic fever. It will be about —

1619. That does not matter. That is three times. Any more?—I have been off at odd times. I have been off several times.

1620. That is more than twice?—Yes.

1621. Do you play football?—No.

1622. Do you go to football matches?—No.

1623. Supposing you were fixing a shed up for yourself you would put some kind of apparatus to soften the atmosphere, to make it weave better, or do you prefer a dry shed?—I should try it first without.

1624. (*Mr. Roberts.*) Supposing you had your humidifying apparatus stopped what would be the result on the weaving, in your opinion. I do not know whether you have any experience which would enable you to answer that question?—It would affect it under the present conditions.

1625. Adversely?—Yes, it would be worse under the present conditions.

1626. What do you mean by the present conditions?—I believe that in the manufacturing, the sizing, and all the different processes that it has gone through, there is so much size in the material, the yarn, that I think the shed would get dry and it would dry the yarn, and it would want moisture somewhere. If they had not moisture somewhere it would break and we should have to have something to make it weave.

1627. (*Mr. Higson.*) Do you think there is more size put on at your place than there need be?—I cannot answer that question. I cannot say.

1628. But you speak about so much size, and such like. Do you know that some size is necessary to make it weave?—Yes.

1629. You do know that?—Yes.

1630. In your judgment there is not too much put on?—No, I do not think there is too much.

1631. (*Mr. Shackleton.*) But you worked the same kind of cloth previously to this Hart's machine being put in?—Yes.

1632. Exactly the same kind of cloth?—Yes.

1633. You would be content if you went back to the same kind of cloth without humidity as you were weaving then?—Yes, I daresay I should manage.

1634. (*Mr. Cross.*) Can you recollect the wages you had some dozen years ago in comparison with the wages you have now?—Yes, I can recollect I got good money when I was weaving. I have always got good money in weaving. I have got over 6s. per loom

yonder, 15 years back. Of course, we get more now. It is the speed that is getting more now, and the advance that they have had. The looms are running quicker—a lot quicker. They have speeded up a lot since.

1635. As far as you remember you think your wages were as good in a dry shed at that time; the weaving was as good?—At the rate that we were running, yes.

1636. (*Chairman.*) You worked longer hours in those days, did not you?—No, the hours are the same. We have had an hour knocked off.

1637. (*Professor Lorrain Smith.*) Does the humidity allow you to run faster?—No, it does not allow us to run faster.

1638. You say they have speeded up?—Yes, that is with the pulleys and the engine—the machinery.

1639. But does the yarn, the thread, stand it better?

1640. (*Mr. Roberts.*) If the humidity was knocked off to-day could you run at the same speed as you are running?—Yes, I do not think it would affect the speed.

1641. It would not affect the speed, but could you weave at the present speed?—Certainly we could.

1642. (*Professor Lorrain Smith.*) You would not have to go back to the old speed?—No, I do not think so.

(*Mr. Cross.*) It would be more brittle, of course.

(*Mr. Higson.*) The witness has said he believes that the humidity softens the warp, and makes it weave better, and at the same time he is saying now that if we go back to the condition of things without humidity it would not affect the weaving. The two statements do not quite tally.

1643. (*Mr. Shackleton.*) I understand you to say your idea is that before they put humidity in you had a different class of yarn and a different sizing. That is your idea?—Yes.

1644. (*Mr. Higson.*) If the humidity was taken out of your mill now it would weave worse?—Yes, I have no doubt it would under the circumstances.

1645. (*Mr. Cross.*) Do you ever hear any expressions of opinion in — in regard to other mills with reference to the question of humidification. I am speaking of weavers now?—Anywhere at the other mills?

1646. Yes, in —?—I can answer you that. I am prepared to say this. It has got well known that I have had to come here, and I have several weavers in our family—my brother and sister—and they work at different places in the district, and I have worked at two mills since I left this firm. I may say that at one of the mills that I was weaving at after I came from this warehouse I was worse in health than I am at the present time working at this place; and they had humidity.

1647. They have humidity? Yes, and I have had several complaints from the same place. They have come and told me when they knew I was coming here.

1648. (*Mr. Roberts.*) What sort of plant have they there?—I cannot tell you, because I did not notice it particularly. I was not there very long. Then there in this mill that I was cloth-looking at. Theirs is, I may say, awful. If you get in contact with any of the weavers there they would soon let you know, if you got some of them from that place.

1649. (*Mr. Cross.*) Objecting to it, or in favour of it?—Objecting to it.

1650. Are there any dry sheds in your neighbourhood?—There is one, a new one which has been started. He has not put any in. It is not running very well at present. He has to keep waiting for yarn, and that, and he has not got it all going. It is an old mill, filled up. It is a small shed, and he has not adopted humidity.

(*Mr. Higson.*) There may be other reasons for not adopting it.

The witness withdrew.

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Mr. E—— H—— called in, and examined.

1651. (*Chairman.*) You are a weaver?—No, I am a loom overlooker, a tackler.

1652. Have you ever done any practical weaving?—Yes, I have done about six years; both here and a short time abroad.

1653. In what country?—Germany and Holland.

1654. What mill do you work in now?—The ——

1655. (*Mr. Shackleton.*) Those are Northrop looms.

1656. (*Chairman.*) Have you worked in any mills where they have not these Northrop looms?—Yes, the —— near Blackburn. They have 1,000 plain and 200 sheeting looms.

1657. You have humidity in the place you are working at now?—Yes, we have humidity—the Drosophore Company.

1658. Does it cause you any inconvenience at all?—No, I think it is a grand thing in cotton weaving.

1659. But that is from a manufacturers's point of view. Do you think it improves the weaving?—I think it improves the weaving considerably.

1660. And what about the health of the workers?—I cannot see any difference at all. In fact, all the weavers, generally speaking, cry out for it to come in if they turn it off half an hour.

1661. That is where you are working now?—Yes.

1662. What about the place you were in before?—The —— Mill; they liked it there for anything I could see.

1663. What were you doing there?—Weaving.

1664. (*Mr. Shackleton.*) What system of humidity had they there?—They had it about 70 I should think.

1665. But on what system. Were they blowing steam off there by jets?—No, they had it the same as the Drosophore, only it is a different company's make.

1666. (*Chairman.*) Do you say you worked in Germany?—Yes.

1667. What kind of works in Germany?—It is rather a rough class of work.

1668. Was it a cotton mill?—Yes.

1669. Spinning or weaving?—Both spinning and weaving.

1670. What did they do in the weaving sheds there?—Humidity.

1671. What sort of humidity?—They are not on the Drosophore system. They are the length of the shed really, blowing out all the way.

1672. (*Mr. Roberts.*) Through the pipes?—Yes.

1673. With little holes in them—something of that sort?—No, it was proper humidity; it was not just bare steam.—It was humidity—hot water.

1674. Running down a trough?—Yes, the same as Hall & Kay's.

1675. (*Chairman.*) Moistened air let in through a tube—was that it?—Yes, that is it. It would go through a 9-inch trough.

1676. What did the workers over there say about it?—I could not speak their language. I had not their opinion upon it.

1677. You do not know what they thought about it?—No.

1678. Do you say you worked in Holland, too?—Yes.

1679. Where did you work in Holland?—Oodenzaal.

1680. (*Mr. Cross.*) That is on the frontier of Holland and Germany. It is a little weaving shed just going from the station, is it not. Whose looms are they?—Butterworth and Dickinson's.

1681. (*Chairman.*) What did they do there. Did they humidify?—Yes, there was humidity there.

1682. How was it introduced?—Introduced in a long trough just the same as here, but not this Drosophore—not the same as our system here. I have worked at Droylsden, the other side of Manchester.

1683. In your opinion do the operatives suffer personal inconvenience, or does their health suffer from the use of humidity?—I think they like it. They do really like it or they would not ask for it as they do if it is turned off half an hour. It makes a terrible lot of difference with regard to weaving, and I do not think if it injured their health they would keep asking for it to come in again.

1684. (*Mr. Roberts.*) You say in these systems which you met with on the Continent there was a 9-inch trough. Do you mean a pipe?—Yes, a round pipe.

1685. (*Chairman.*) Did they warm the air when it came in?—I think it was blown in from the engine.

1686. In winter did it feel as if it had been warmed in any way?—Yes.

1687. (*Mr. Cross.*) You said when it is turned out the weavers ask for it to be put in again. Is that at the present mill you are at?—Yes, the ——

1688. How long is it since such a thing occurred?—Only last week.

1689. Did they ask you about it?—No. Well, my weavers, as a rule, when they see this Drosophore stopped will ask me why they are stopped—"Just push it forward and go and see why they are stopped"—and I go and see the cause, and sometimes a pump has broken down. In fact, the last thing there were a few teeth broken in a Drosophore pump, and my weavers were complaining very soon about it.

1690. Did they notice that the machine had commenced to stop?—Yes, a terrible lot.

1691. They are all Northrops, are they?—Yes, 1,000 within about eight.

1692. How many looms are they apiece?—24. We have 84 in a set.

1693. When you were at the ——, was it summer time?—I was there both summer and winter.

1694. Do you remember any feeling that you had of being uncomfortable. I think you said they had the Drosophore system there?—It is not the Drosophore make, but it is on that system.

1695. Something similar?—Yes.

1696. Did you yourself feel uncomfortable in summer time on account of these humidifiers going on?—No, I do not think I did. I never felt any difference whatever.

1697. You were weaving there?—Yes.

1698. (*Mr. Shackleton.*) Were you in the sheeting department?—No, I was in the narrow loom department.

1699. (*Mr. Higson.*) Of course, you would feel overheated in summer like everybody else?—It feels rather warm. Of course, it does in any shed where there is machinery running.

1700. Have you taken any notice of the diagrams of temperature at all when you were at the ——? No, not at the —— Mill, but I have here.

1701. What is the highest temperature that has been recorded at ——?—I could not say the highest, but I have seen it pretty often at 70.

1702. (*Chairman.*) How long were you abroad?—About six weeks. I was there for the Northrop loom. I was weaving there.

The witness withdrew.

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Miss E—— M—— called in, and examined.

1703. (*Chairman.*) Are you a weaver?—Yes.
 1704. Have you been a weaver long?—Yes.
 1705. How long?—Since I was about 11, and I am 23 now.
 1706. Where are you working now?—At ——
 1707. Those are Northrop looms?—Yes.
 1708. How long have you worked there?—Since August.
 1709. And before that?——
 1710. How long did you work at ——?—Since I was 11. I started there.
 1711. You were a good many years at ——?—Yes.
 1712. Do they humidify there?—Yes.
 1713. What system of humidity?—Do you mean the steam?
 1714. Yes. Is it live steam?—Yes.
 1715. Just from a jet?—No, it is from those humidifiers.
 1716. It is like a big drum with pipes round like that, that send it out (*indicating*)?—Yes.
 1717. They have Hart's system there. Have you felt any inconvenience which you would attribute to the use of humidity?—It never makes any difference to me—just for the work it does, of course, because we could not do the work without them.
 1718. I should like to hear about your health?—No, it has never made any difference to me.
 1719. You have not suffered in any way on account of the introduction of humidity?—No, I have not.
 1720. What is your opinion in regard to weaving. Is it better with it or better without it?—We could not really work a minute without this steam in.
 1721. (*Mr. Shackleton.*) That is where you are at now—at ——?—At —— now.
 1722. (*Mr. Roberts.*) But how would you have gone on at ——?—The same. We could not work without steam.
 1723. Did you make plain cloths at ——?—Yes.
 1724. Not fancy goods?—Yes, and fancy goods.
 1725. (*Chairman.*) You read the papers, I suppose?—Yes.
 1726. I daresay perhaps some of the trade papers?—Yes.
 1727. Have you seen it stated that a great many people, a very large number of people, have suffered in health?—Yes, I have read a lot lately about it.
 1728. Do you agree with them or do you not agree with them?—Well, you see, we could not work without them.
 1729. And you say, personally, as far as you yourself are concerned, you have not suffered in health?—No, in no way.

The witness withdrew.

Mr. R—— O—— called in, and examined

1751. (*Chairman.*) Are you a weaver?—Yes.
 1752. Where are you working?— ——, Blackburn.
 1753. How long have you worked there?—It is only a new mill. I have worked there since it commenced, but I worked at their other place before, about 15 years.
 1754. How long is it since the present mill began?—Fourteen months since I started.
 1755. Where did you work before?— ——, under the same firm.
 1756. And for how long?—About 15 years at ——
 1757. At —— did you work in a humidified shed?—No, they had no humidifiers there.
 1758. It was a dry shed?—Yes.

1730. Can you say anything about other people—whether they suffer in health?—I have heard some say that they have.

1731. (*Mr. Roberts.*) Have you any friends who have stated that they are off ill through steaming?—No.

1732. None of your friends?—No.

1733. You have only heard of it, that such things have occurred?—Yes.

1734. But you have not come across any?—No.

1735. Which system do you prefer, the one which you have at this place where you work now, or the one that you had at ——?—This where I am working now.

1736. Can you tell us why you prefer it?—Yes, I think it is a higher place, bigger altogether. And another thing, we have a cloak room here, and in —— we had to hang our clothes on the wall, and the wall used to get steam on it. It is a lot better here.

1737. But which shed did you prefer to work in from the steam point of view?—This one I am working at now.

1738. You prefer this water arrangement to the steam?—The water?

1739. It is water, is not it, in the present place, in the place you are working at now?—I thought it was the same.

1740. It looks the same. But which do you prefer?—I thought it was the same, but I would rather have this shed.

1741. (*Mr. Cross.*) You have never worked in a dry shed then?—No.

1742. (*Mr. Roberts.*) When you were working at —— place, did you experience any draught from the machines there?—No, it never affected me at all.

1743. (*Mr. Shackleton.*) Have you worked under one of these machines at ——?—No, not right under.

1744. Some distance away?—Some distance away.

1745. Did you hear any weaver complain that worked under them?—Yes.

1746. What did they say?—They have complained about the steam.

1747. Just underneath it?—Yes, and they have had colds and that.

1748. (*Mr. Cross.*) Did they complain of the draught?—Yes, giving them colds.

1749. Were there many weavers off work at any given time in —— Was it a shed where the weavers were often away through being ill?—No, not different from any other.

1750. Your experience of weaving is limited to these two mills?—Yes, I have never worked anywhere else.

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Mr. R— O—

1765. (*Chairman.*) As a matter of fact, as far as steam is concerned, you worked under the same conditions in both places?—Yes.

1766. You have had experience of about 16 or 17 years in a place where steam is introduced?—Yes.

1767. What opinions have you formed in regard to the comfort of the weaver. Is it interfered with by the use of this steam?—Weaving do you mean?

1768. I am not talking of weaving. I am talking of the feelings of the workers?—Yes, when there is a large amount of steam in it does away with all energy. You do not feel inclined to work the same when there is a lot of steam; you have not the same energy to work.

1769. If there is a lot of steam introduced you have not the same energy to work?—No.

1770. But you say a lot of steam. Supposing that it is let in in a moderate amount, would that affect you?—They never do let it in in moderate amounts that I know of—not that moderate that it would not affect us. Any amount would affect us in summer time, more so than in winter.

1771. In summer time you feel it more than in winter?—Yes.

1772. What does it do in the summer. What effect has it. Does it make the room hotter?—It creates a dull feeling and you cannot get the same work off your hands when there is a lot of steam in summer time.

1773. You feel you have less energy and less inclination for work?—Yes.

1774. Then as regards the output. Does it improve the output or otherwise?—Yes, it will improve the output, but I think they could devise other means to keep the output up to its present standard without steaming.

1775. What would you suggest?—I think it could be managed in the tape room—in the slashing room.

1776. (*Mr. Shackleton.*) When the warp is going through the size box. That is what he means.

1777. (*Chairman.*) But would not it dry on the beam?—They could put stuff on that would not get dry to the same extent. There are mills worked without steam.

1778. If they put the stuff in, would not it produce mildew on the beam?—No.

1779. Then the remedy you suggest would be to allow more moisture to remain in the stuff while it is on the beam?—That is so. The steam is to soften it in the mill when it gets dry.

1780-1. Do not you think that more moisture would produce mildew on the beam?—Well, I do not think it would.

1782. At any rate, that is the remedy you suggest?—Of course, you could put a certain amount of tallow on that would not do that. That would stop that mildew or other things.

1783. How long have you been a weaver?—I have worked for — for 16 years.

1784. Have you been a weaver all your life?—Yes.

1785. How long is that?—I have worked over 30 years as a weaver.

1786. And what sort of health have you enjoyed generally?—I have nothing to complain of in health. I have had very good health up to the present.

1787. We will take the last 18 years in which you have worked in the sheds where steam is introduced. How often have you been off on account of ill-health?—I have not been under the doctor these last 18 years, but I have had, we will say, about a month in all off—with colds and that sort of thing.

1788. A month off on account of health—not ordinary holiday making?—No.

1789. I do not know whether you belong to a society which pays you sick pay?—I have not had three weeks' sick pay, I think.

1790. In your whole life?—In those whole 18 years.

1791. Supposing anybody said to you, "It is proposed there shall be a law saying that there shall be no humidity introduced into mills," would you say

"That is good" or would you say "That is bad"?—To give over introducing steam do you mean?

1792. Not necessarily steam, but humidity of any kind. Of course, there are different ways of introducing humidity. There is steam and there are water sprays, and different ways of doing it; but supposing somebody came to you and said, "The Government are thinking of saying that there shall be no humidifying in weaving sheds," what would you say to that?—I should say it would not be any harm to do without steam. It would be healthier without steam, I do think. I have had no experience with these cold water sprays. I have never seen any.

(*Mr. Higson.*) The question wants submitting in this way: Supposing the Government said there should be no dampness of any sort put in a weaving shed?

1793. (*Chairman.*) What would you say to that?—I think a certain amount of dampness does keep the dust down.

1794. Does it do anything else?—Well, in some cases it turns more work off. You can turn more work off with dampness.

1795. More work means more wages, I suppose?—That is so.

1796. And you have to consider it from two points of view. You have to consider the comfort, and the wages—both. Is that it?—Yes, that is so.

1797. (*Mr. Shackleton.*) I take it you have an idea then, that if they would size differently, you could do without steam?—Yes.

1798. That is what you have at the back of your mind?—Yes.

(*Mr. Higson.*) Some would be glad to know how to do it. If you have a recipe for it, I shall be very glad to make it worth your while.

1799. (*Mr. Roberts.*) You have had no experience?—No.

1800. You suggested if you put more tallow in, it would do away with steam?—That would be a help to it. I do not suggest that would do it altogether.

1801. If I were to tell you it would not help at all, what should you say. You could not contradict it?

1802. (*Mr. Shackleton.*) Your idea is, that if the yarn was better it would not need as much steam?—No.

1803. That is generally what you hear amongst the weavers, is not it?—Yes, that is so.

1804. (*Mr. Cross.*) Have you ever worked in a dry shed without steam?—No, I have never worked in a dry shed without steam. I have only worked where there has been steam.

1805. (*Mr. Higson.*) You spoke just now of a lot of steam being put in, which rendered it uncomfortable. In the mill you are in now do you ever get what you regard as too much steam?—Yes, in summer time we get too much.

1806. That, of course, is a different thing. Do you get too much moisture?—Where I work we do not get too much. Of course, I work up against the wall, and the steam travels at the other end of the mill.

1807. The walls, as a rule, attract the humidity?—I am near the door, where I work, and it drives it further down the shed.

1808. We have been in the shed. Is not every other loom a Jacquard?—No.

1809. There are a great many of them?—Yes, there are a great number of them.

1810. Does not the steam affect the cards if it gets too much?—Yes, if the steam gets too much it affects the cards.

1811. Supposing you get a lot of steam, or too much dampness, as you regard it, they would not be able to get on so well with the Jacquard looms?—No.

1812. Then you would come to the conclusion they do not put more in than will just go on straight?—It is very seldom the Jacquards will not go on. It once did occur, but they have altered it since.

1813. (*Mr. Cross.*) Do you remember a visit being paid to the shed?—Yes.

Mr. R— O—

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1814. Was that shed in its normal condition that day. Was there the usual steam going on, and was everything about it as on any other day?—No.

1815. Was there less steam?—Yes.

1816. (*Mr. Roberts.*) That afternoon?—Yes.

1817. (*Mr. Cross.*) What leads you to that conclusion or observation?—I took particular notice, and so did the majority of the weavers.

1818. Took notice that there was less steam?—Yes.

1819. That shed was not in its normal condition, then, of steam?—No.

1820. (*Mr. Roberts.*) The readings of the day showed it. That shed where you work has a great many steam jets in it?—Yes.

1821. I presume you, as a weaver, have been in many sheds in Blackburn where you have not been really employed?—I have been in very few sheds.

1822. But you have been in some?—Yes.

1823. Where steam jets are in use?—Yes.

1824. In this particular shed, — Mill, you will find, I think, that you have more than double the number of steam jets from what you would have anywhere else?—We have more than double the number of steam jets at other places.

1825. And yet, for all that, you have no excessive humidity?—No.

1826. Yet you have so many steam jets that there is one to every four looms?—There is one to every four looms.

1827. (*Mr. Higson.*) The bulk of your work is very fine, is it?—Fine and medium.

1828. (*Mr. Cross.*) Which shed do you prefer—the one at —, or the one you are in now?—I prefer the one I am in now.

1829. Is it a better shed?—Yes.

1830. (*Mr. Roberts.*) Although it is so heavily steamed?—It is a better shed. It is higher for one thing. The steam can get away better.

1831. (*Mr. Cross.*) What is the opinion of the work-people about the mill, or anywhere about, in regard to this humidity and excessive moisture being used for weaving. There are no dry sheds about there, are there?—No, not that I am aware of.

1832. Has there been any expression of opinion that they would like to be without steam?—They all say that they would like to be without it if they could manage without it.

1833. Even at this new mill?—Yes.

1834. (*Mr. Roberts.*) But do you think they could manage it?—Not under the present conditions, as they are now, we could not.

1835. (*Mr. Shackleton.*) You do know that similar goods to yours are being made in thousands without steam?—Yes.

1836. (*Mr. Roberts.*) How do you know that?—I have been in conversation with weavers in different parts, and they have told me as they do not steam. In —'s they do not have any steam there. They make a lot of the same class of goods that we do, and they did not use to have any steam there. There are others I have not been in, but that is particular conversation with workpeople.

1837. You say they did not use to have any steam?—No, and I do not know that they have yet.

(*Mr. Roberts.*) They have to-day.

The witness withdrew.

FIFTH DAY,

Thursday, 6th February, 1908,

At Manchester.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
Mr. H. HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor J. LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

Mr. DOCTOR GOULDSBROUGH, called in and examined.

1838. (*Chairman.*) What office do you hold?—I am Secretary of the Blackburn and District Power Loom Weavers.

1839. Does that include both humid and non-humidified sheds?—They are mostly humid; I do not know that there is a single one in Blackburn that is not.

1840. Might I ask how long you have held the office?—Nearly two years now.

1841. Before that what were you?—Assistant Secretary to the same body.

1842. Your present work, I take it, is generally office work?—Yes.

1843. What practical experience have you had in mills?—It is some fourteen years now since I left the mill.

1844. In what department did you work then?—As a weaver.

1845. For how many years as a weaver?—Fifteen years about.

1846. In the days when you were a weaver had the question relating to humidity been given much attention to?—Yes, in the Blackburn district particularly.

1847. Was there much humidifying used in that day?—Yes, considerable.

1848. In what form?—The same as to-day—steam.

1849. Of course in these days there are a good many new methods of introducing humidity other than by steam?—Yes.

1850. Did they exist in those days?—No. I only know of a few sheds where there are different forms to-day. I cannot say that any existed other than the ordinary steam arrangement in those days.

1851. Have you formed any opinion so far as the health of the workers is concerned as to whether the novel methods, such as in some cases spraying water, are better than steam, or is the old steam method the best do you think?—There is one in Blackburn to-day which so far as the general shed is concerned I am given to understand is superior to the ordinary steam

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method; but just in the immediate neighbourhood of this arrangement the weavers complain very much of dampness. It is a spraying of water. The firm said to me on one occasion that they could considerably reduce the temperature during the hotter months—I just forget the amount claimed, but that is not tested in any shape or form. That was just a statement by the firm.

1852. Can you tell us the name of the mill?—The ——— Mill, Blackburn.

1853. Do you know what system they have there—by what name it goes?—I do not know the name. It is water spraying. It is warm during the winter season. (Mr. Shackleton.) It is the Vortex.

1854. (Chairman.) One of the workers said, I think, there was a good deal of moisture fell on him?—Yes, just in the immediate neighbourhood of the appliance.

1855. Speaking generally throughout the shed what is the opinion of the workers?—That as a general thing it is superior to the other method considerably.

1856. It gives them greater comfort?—Yes.

1857. Talking of steaming—and by steaming I mean the introduction of steam by jets or any other method—do you think that that produces discomfort for the workers?—They say so generally. Of course there are sheds where it is worse than others, but the complaints we do get principally are during the hotter months of the year. I had several complaints last year and the year before of live steam being poured in all the day through right down to 5.30 in the evening, the temperature being 91° or 92°. It is quite obvious that that is not a temperature that is fit to work in for the occupation of a weaver.

1858. I understand they say it produces discomfort?—Yes.

1859. Does it produce illness?—They allege so. I have heard it said on several occasions that it produces rheumatism and chest complaints.

1860. Have you at any time felt the clothing of the workers in these places to see if it had a damp feel?—I have felt my own damp when I was in a mill.

1861. Was that the clothing that you were working in?—Yes.

1862. Or was it the clothing that you hung up?—The clothing that I was working in was similar. I was close to the wall. And the jacket I wore at that time when it was taken down at meal hours and in the evening was quite damp.

1863. (Professor Lorrain Smith.) Was the wall damp?—I will not say particularly so; it was not more so than an outside wall. You find it the same when you hang your clothing on the pillars.

1864. (Chairman.) I take it that in your capacity as Secretary to the weavers anything affecting their wellbeing will come to you?—Yes.

1865. Has there been any strong feeling in your district with regard to the practice of steaming and also—I mean to draw a line between steaming and humidifying; and by steaming I mean the introduction of steam for humidifying, although it would, of course, include other methods—I mean in this instance to refer to the water spray—has there been any strong feeling expressed by the workers on the different systems—first of all on the whole thing?—On the general question there are undoubtedly large complaints so far as they are concerned. As a body, they desire its total abolition. With regard to the other form of humidity, there is only one that I know of in our town, the ——— Mill, and they say in other parts of the shed it is preferable to pouring in live steam.

1866. (Mr. Roberts.) Our Chairman wishes to ask whether you know any systems in Blackburn where they have large pipes through which they send humidified air. You have some of those systems in Blackburn. He wants your opinion on that style of system, if you can give one?—I only know of that one system. The only other one is the ordinary steam jets.

1867. (Mr. Cross.) You have not been in any of those mills where there are such methods?—No.

1868. (Chairman.) I gather that you say there is a feeling that humidity should be entirely done away with?—Yes.

1869. Of course, we have to realise that practically throughout the civilised world where weaving is done humidity, in not every instance, but generally speaking, is found. Do you think that the operatives have realised what the possible effect on wages might be if such a law were passed?—There are other reasons, perhaps, why they have not considered that point of view.

1870. Let us hear them?—That is the question of the amount of production; it is not always desirable so far as they themselves are personally concerned—I say it is not so much a question of wages with the operatives as it is with the firms here demanding that a certain production should be attained.

1871. Let me follow you. You say the firm says that a certain production must be maintained?—Yes.

1872. Is not it the system to pay by what the production is?—Yes, by piece.

1873. Do you mean that the firm would be dissatisfied with a weaver who produced anything beyond a certain minimum?—Would be dissatisfied with anything below what they considered a fair production.

1874. Below a certain amount they would be dissatisfied?—Yes; in other words the operatives consider it first of all from a health point of view.

1875. But what is your opinion as a practical man upon this: were humidity totally dispensed with what would be the effect on the wages of the workers?—Well, I can hardly answer that question, because I do not know what would be the effect. From information I have had, something like one-half of the trade work without it; but, of course, they may be producing different classes of goods. We had a mill in Blackburn until recently that worked without it, and I never heard any complaints about it.

1876. We have had various workers before us, some of whom said that they could not weave without it, others that they would not wish to weave without it. I ask you this question because after all whatever conclusion may be arrived at, this wage question has a very important bearing as far as the operatives themselves are concerned, and it is one that I hope they will consider. You speak about this particular shed where there is humidity obtained by means of water; have you gauged the feeling of the workers in that shed—would they wish that stopped?—I have never taken the opinion of them generally. So far as that shed was concerned, the production from that shed was greater than from many other sheds in the town from that system. They do not appear to complain largely about it except as I say in the immediate neighbourhood of the appliance.

1877. That probably might be some local defect which might be remedied?—Possibly so.

1878. You are not able to say definitely what their wishes would be as to whether it should be stopped or not?—Taking their wishes, undoubtedly they would ask for the abolition of humidity—as a general body. There may be of course exceptions.

1879. (Mr. Roberts.) You mentioned a shed a little while ago where they had recently begun to humidify?—Yes.

1880. What system did they put in?—I cannot tell you; I did not inquire, it not having been in long.

1881. Do you think that your weavers would consent to do away with humidification in heavy-sized goods?—As a general thing our people desire its abolition irrespective of the quality of cloth made.

1882. If it were abolished in heavily-siezd goods what would be the result in your opinion as a practical weaver?—Well, taking the conditions of to-day of course there would not be the same output.

1883. How much do you think it would be reduced, say in winter time, with dry east winds, and in hot weather?—I could not say, because the conditions would vary from day to day; it is possible you might have one week with one kind of atmosphere and another week with another kind of atmosphere.

1884. Do you think the average would go down 25 per cent.?—I should not think so.

1885. Do you think the average would go down 20 per cent.?—I should not think so. I should think 10 per cent. would be fair, even if it were that.

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1886. You said a little while ago that the —— Mill got the best average?—I ought to say that it is a new shed with all new machinery.

1887. That is a light-sizing place?—Very much mixed. I do not think there is any very heavy sizing. It is a mixed trade they do.

1888. But it is a light-sizing place?—Yes, I do not think it is a heavy-sizing place at all.

1889. What would be the average drop there if they were to stop this Vortex humidifier: would it drop a shilling a loom?—That is a question I could not answer. You could not say yourself. I do not think personally it would have very much effect at that mill at all.

1890. Has it had any effect upon the average at this place where they have recently put in this humidity?—No, I do not think it has.

1891. You maintain here that the Blackburn weavers in their present sorts of cloth would be quite willing to do away with all artificial humidity and bear the loss in wages?—Yes, if you take the body of people you would find the same result. They view it from a health point of view. They do not take into consideration the other point of view in the complaints that have reached me.

1892. (*Mr. Cross.*) There has been a ballot of the weavers taken, has there not?—Yes.

1893. Do you remember the figures that were returned—do you remember approximately the difference between the Ayes and Noes?—There was an overwhelming majority in favour of total abolition.

1894. (*Chairman.*) Was this in Burnley?—In Blackburn.

1895. (*Mr. Cross.*) Do you think it is possible that these heavy-sized sheds in Blackburn buy a better class of yarn and would be able to do without steaming and be able to avoid the great loss as mentioned in the previous question?—Yes.

1896. That would make a big difference in the possible loss—the difference in yarn—do you think?—I do not think there would be any loss at all of any moment.

1897. That is if the quality of yarn were improved?—If the quality of yarn were improved.

1898. (*Mr. Roberts.*) I suppose, Mr. Gouldsbrough, you have no experience of what the actual effect humidity has on sized yarn?—It is for the purpose of damping it, that is all.

1899. Would you say this: that if you were sizing up to 100 per cent., or even 150 per cent., which is being done in Blackburn, and you were to take out this humidity, the production would not go very seriously lower?—I have already said I should not have thought it would take 10 per cent. In view of the question put by Mr. Cross, I should think the loss would be very little indeed by using an improved quality of yarn.

1900. (*Mr. Cross.*) May I ask of what class of goods you were speaking?—Dobby dhooties.

1901. Very heavy-sized?—Sixty per cent.

1902. What is your feeling with regard to that particular shed in summer time—it was the old steam jet?—The old steam jet.

1903. What were your feelings with regard to that in the summer season?—General oppression, and in the afternoon it was almost like walking into an oven.

1904. (*Professor Lorrain Smith.*) That is a humid shed?—That is a humid shed, the temperature anywhere averaging between 80° and 90°.

1905. You said that the temperature might rise to 91° or 92°?—Yes.

1906. How often would that occur?—I could not say. I had two cases reported to me last year of over 90°.

1907. On two days in the year?—Two separate sheds.

1908. On one occasion each?—On one occasion each.

1909. So that it is not very frequent?—I should not say it would rise to 91° or 92° generally.

1910. Have you noticed at what temperature it becomes oppressive?—I should say if you get much

over 70°. In the hotter months you get over 80°; that is the time you feel it most.

1911. Over 70° you said; you mean 75°?—I should say 70° to 74° or 75°.

1912. In what period of the year do you have those temperatures?—You find them getting over 70° occasionally—I did then—even in the back end of the year before the winter season set in.

1913. How long is it—one month or two months or six weeks in the year?—I should say stretching from mid-June towards the end of August.

1914. That is a little over two months?—That is a little over two months at the worst.

1915. At the other period of the year is there any real trouble either in the way of discomfort or otherwise?—The discomfort is the ailment which they say arises from it.

1916. I was not thinking of ailments, but discomfort, that is, bodily discomfort at the work?—The discomfort really is in the condition of the floor and the general feeling of dampness surrounding you. The floors in most instances are wet, and the workers are slipping about the place. The discomfort is the feeling arising from dampness, which seems to settle on the clothing you are working in, and it is not so pronounced in the winter months when the temperature is not so high as it is in the summer.

1917. Do you say if one goes into a weaving shed one will find the floor damp as a rule?—Yes, in many many cases, like the streets of Manchester to-day; similar.

1918. As damp as that?—Yes, many of them.

1919. (*Mr. Shackleton.*) I should like to ask you one question with regard to clean water. What is the feeling of the operatives with regard to the use of canal and river water in Blackburn?—It is decidedly objectionable.

1920. Do they complain about the smell?—Yes, about the smells arising from the steam.

1921. Has there been recently a decrease in the use of clean water?—Yes, I think there has.

1922. You have heard more complaints?—I have heard more complaints about it.

1923. With regard to those complaints I take it that there is not an overwhelming number coming and reporting to you directly?—No.

1924. The complaints you will get will be through the committees. For instance, you have a committee of how many?—Eighteen.

1925. Those eighteen men represent all parts of Blackburn?—Yes.

1926. Probably you hear more about complaints through conversations in the committee room than you do from the operatives themselves?—Yes.

1927. There is a system by which the committee report these things, not the weavers directly?—Yes, except in cases where it gets beyond reason. Where they are pouring steam in they say it is "insane" in the summer months.

1928. With regard to this question of dampness, do you hear much about that, and what kind of sheds are they chiefly that the complaints come from: are they the light-sized sheds or the heavy-sized sheds or what?—They are mostly heavy-sized sheds.

1929. That is where they think the humidity is excessive, where they think there is more humidity than there ought to be?—Where they exceed what they term reason.

(*Chairman.*) Mr. Shackleton, will you mind asking the source from which the water in Blackburn is generally obtained.

1930. (*Mr. Shackleton.*) I think we might follow that up. There is the canal?—Yes.

1931. And there is the River Blackwater, is not there?—Yes.

1932. And mill lodges generally?—Yes.

1933. Those mill lodges, of course, are used for condensing purposes?—Yes.

1934. The water is changed from time to time in a great many instances?—Yes.

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1935. (*Mr. Cross.*) The lodge is not emptied; the lodge is never emptied?—That is so.

1936. (*Mr. Shackleton.*) Except in occasional cases. Now with regard to the questions about production. Is it a fact that a large number of mills in Blackburn work on what is known as a low-class dhooty, that is to say, a fair amount of size and not much yarn?—Yes.

1937. And the impression of the weavers is as conveyed to you I take it this: that these low-class shirtings or dhooties as they call them, on account of their construction and the heavy size they put upon them in the opinion of the weavers need the humidity—that is because of their construction and the heavy size?—That is so, exactly.

1938. And in other kinds of goods or this kind of goods if made from a superior kind of yarn they would not need it?—Yes.

1939. That is the general statement you get through your committee?—That is so.

1940. (*Chairman.*) Have you formed any opinion as to what would be the increased cost to the purchaser we will say supposing superior yarns were introduced in place of these inferior ones?—No, I could not say; it is variable of course.

1941. I take it that there is a demand for this low class of goods or they would not be made?—There is, or they would not be made.

1942. Perhaps it would be beyond what a Government would interfere to do, to say what class of goods should be made or should not be made, but just suppose for the sake of argument that the Government interfered and said what kind of yarns had to be used: might not that have the effect of driving certain trade out of the country altogether?—The operatives contend that if the system of humidification were abolished the trade would soon rectify itself; the trade would adapt itself to it. That is their opinion.

1943. Might it not be that all these classes of goods would be made on the Continent and in other countries?—I do not think there is quite so much of this trade now as there was here.

1944. (*Mr. Shackleton.*) Can you tell the Chairman the amount of yarn there is, say twist yarn, in an ordinary shirting length; what weight there would be of yarn alone just an ordinary 37½.

1945. (*Mr. Roberts.*) 4 lbs.?—It would not get to 4 lbs. would it?—I should say it would be between 3 and 4.

1946. (*Mr. Shackleton.*) That cloth is valued at a certain price?—Yes.

1947. One penny per pound would be the increased cost?—Yes.

1948. That would make a great difference in the weaving?—Yes.

1949. 4d. on what?—On a cloth valued perhaps at 8s.

(*Mr. Cross.*) 37 yards long.

(*Mr. Roberts.*) Cloth valued at 5s. 9d. to-day, not 8s. 4d. a piece on that would mean absolute ruin to the trade.

(*Chairman.*) It would be better if you put that in the form of a question rather than give it as an

opinion, or if you got it in the form of an opinion when you are examining some of the manufacturing witnesses.

1950. (*Mr. Cross.*) Have you ever heard a weaver express any opinion whether he cared to keep that trade or not?—The general opinion so far as that trade is concerned is that it is better lost than found.

1951. (*Chairman.*) A question has cropped up from time to time at all former Committees, but I do not think as far as we are concerned we have hitherto asked any questions about it. You know that readings have to be taken of the wet and dry bulbs, and returned to the Home Office?—Yes.

1952. That is in humid cotton cloth factories?—Yes.

1953. I do not want to imply any suspicion or any improper motives to anybody, but we know that in all walks of life there are careful men and there are careless men, and it has been suggested that in some instances those readings have been taken in a careless way, and they are not reliable. Do you think looking at it from the operatives' point of view that there should be any check, or that the operatives themselves might have somebody to check the readings, or can you suggest any method of taking the readings which would give greater confidence in them to the operatives for whom I take it you are speaking?—I have heard various complaints about it that they are not taken accurately in many instances, but I cannot give any definite proof of it. The statement has been made.

1954. In order to make the operatives believe and feel certain that these readings are accurate and reliable can you offer any suggestion?—The only suggestion I could offer would be to take it out of the hands of the officials of the mill altogether, and leave it to an operative. That is the only thing I can suggest. Those readings have to be taken at present.

1955. But then the other side would have something to say?—Yes, exactly.

1956. Is not there such a thing as this, that on Committees and on various occasions there are people who do not always agree but who work very harmoniously; could not some system of that sort be introduced in a mill?

1957. (*Mr. Cross.*) May I assist upon that? Do you think that a mill representative as understood now in Blackburn, a man the employer knows and recognises as far as their dealings are concerned, and known to the manager, if he were employed would do away with any doubt with regard to the readings?—That is exactly what I was going to suggest. We have a representative in each mill in Blackburn who is recognised by the employer. If any system could be introduced to give satisfaction to this person it would give satisfaction to the weavers.

1958. (*Chairman.*) Do you think he could be called upon to sign them in conjunction with the manager or whoever does sign them now?—Yes.

1959. This representative is known to the employer?—Yes.

1960. (*Mr. Roberts.*) Does that obtain in all districts where a millowner knows the representative?—I do not know. I only speak of Blackburn. In many instances in North-East Lancashire it has to be a representative of the committee who has to work in each mill.

The witness withdrew.

Mr. ROBERT HARGREAVES, called in and examined.

1961. (*Chairman.*) What office do you hold?—I am the Local Secretary of the Weavers' Association at Padiham.

1962. Is that a district in which humidity is largely used?—Yes.

1963. And, speaking generally, what classes of goods are manufactured?—Generally light-sized goods.

1964. How long have you been the Secretary?—Between nine and ten years.

1965. And what practical experience of weaving had you before?—Twenty years.

1966. Did you work as a weaver?—Yes.

1967. You have worked, I suppose, in dry sheds and in humid sheds?—Yes.

1968. And have you received any complaints from the members of your organisation in regard to humidity?—Yes, we have had them many times, but we deal with them by direct representation to the employer in cases where they are not outside the present Act.

1969. What is the feeling in your district: have they gone as far as to say that they would like to see

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humidity done away with altogether?—Yes, they have. They have had a ballot taken some eight or nine months ago, speaking from memory; the numbers were 3,000 odd in favour of its abolition, and less than 100 against its abolition.

1970. Did that apply to the introduction of humidity in any form whatever?—Yes.

1971. As you know there are different ways; there is live steam and there is water?—Yes.

1972. Which system is better for the comfort of the workers?—That is difficult to answer. We have one system, the water system. There were very strong objections against it when it was introduced in one of our mills at the first; but they have since then modified the form of it; and though complaints come occasionally they are not quite as general now as they were at that time.

1973. Have you fewer complaints where the water spray exists than where the live steam was introduced?—I do not know that there are any fewer there than there were in the other case.

1974. Looked at from a weaving point of view, do you think that the introduction of moisture renders weaving more easy?—Granted certain conditions of the sized warps, yes. We have one mill in — which is considered a dry shed. In this place they make practically as many kinds of sized goods as anyone, and they get even the comparatively heavy-sized goods that we have in the district woven without any moisture.

1975. What about the ventilation in that mill?—Of that I cannot speak. They have no mechanical ventilation.

1976. I do not say that it is so, but we will say just for the sake of argument that the ventilation is all stopped, there might then be a great deal of moisture from respiration and perspiration?—That is so.

1977. At the expense of a pure atmosphere?—Yes.

1978. Have you considered that question?—No, I have not.

1979. Have the weavers who say that they would like to see humidity totally abolished considered the effect on wages which that might have?—Yes, I think they do that. They generally make this statement also, that so long as they have humidity so long they will also have inferior yarn sized also to make it weave.

1980. The inferior yarn, I take it, naturally is to produce an inferior cloth?—Yes.

1981. Which I take it is sold at a lower price than it would be if the yarn were better?—I do not go on the market so I cannot tell you that.

1982. Is not it a common-sense deduction that if the article is inferior it will fetch a lower price?—Not necessarily that. If they can get the yarn together in the form of cloth without imperfections by the use of steam they get the same price for it, I should say, in the market.

1983. Supposing that they had to use a higher class of yarn is there a danger of the purchaser having to pay more?—I cannot say that. Of course if they want an excellent cloth they have to pay a better price and the employed knows then that the class of material has to be better than ordinary.

1984. I do not say that such a proposal will be made, but suppose, for the sake of argument, that the Government said to the manufacturers, "You shall only use a certain class of yarn." They might say, "I shall have to put up the price of my goods, and you may lose a considerable amount of trade." Has that been considered?—No, I do not think that point has been considered.

1985. Then would you personally suggest that artificial humidity should be entirely dispensed with?—Yes, I should be speaking the opinion of my members and my own personal opinion, brought about by my own personal experience, when I say that I should like to see it abolished.

1986. Or failing total abolition, because, of course, we have to remember that there are a great many people whose opinions have to be consulted, and some

people would not go as far as you—failing total abolition, is there any modification that you would suggest that might benefit the workers?—The modifications that I have in my mind are these—a less percentage of moisture than is at present allowed by the Act. Another point is this: We find, by practical experience, that the sheds themselves differ in various portions of them as to the amount of humidity that gets into them. I think that the dampest portion should be the standard for the whole shed, because the work-people that have to work in the dampest portion have to feel the effects, and if that is not the standard for the whole shed they are getting the effects more than they ought to do. Further than that, in the summer months, when we get an extraordinary heat, the sheds, of course, get heated in proportion, and I think that humidity, when the heat has got to a certain point, ought to be stopped altogether.

1987. On that point, I would like to put this question to you. It has been suggested to us that, by using certain water-spray systems in the summer, the temperature might be considerably reduced, instead of its being increased. Now, would you approve of such a system, provided that it did produce that result?—So long as the shed did not get above a certain point, and we have to allow a certain amount of humidity, then granted under that condition, it would be feasible to put moisture in.

1988. You see, we will take a very hot summer: perhaps the outside temperature might be up to 85° or 90°. It has been suggested to us that, by the use of cold water for the introduction of humidity, the inside temperature might be brought down below the outside temperature?—Yes, I believe those water systems do that now; still, we have sheds in the town where many a time in the summer the heat gets to over 90°, and still the humidity goes on, and the operatives feel the effects of it during most of the day.

1989. (Professor Lorrain Smith.) How often does it get over 90°?—I have one shed in my mind. In summer time, and even in this last summer, that was not a very hot summer, it was reported to me—of course, I did not get the official figures you understand—it was reported to me several times during the last summer that it was over 90°.

1990. You spoke of a certain point of temperature and humidity being reached?—Yes.

1991. You did not say what that point was?—My point is a very low one: it is 72°.

1992. 72° dry bulb?—Yes.

1993. And what humidity, the other condition that you mentioned?—That is the point. The present Act is 72°–69°; it ought to go down two points in the humidity.

1994. To 67°?—Yes.

(Professor Lorrain Smith.) That would leave 74 per cent. of humidity instead of 84 per cent.

(Chairman.) That is 74 per cent. relative humidity.

1995. (Professor Lorrain Smith.) Do you think if it did not rise materially above 74 per cent. of humidity there would be no cause of complaint in the weaving?—No, I do not think so.

1996. Really the complaints that you have described to us arise when the temperature goes above this limit that you have mentioned with the humidity?—The point is before the temperature what is the amount of humidity. We get complaints about the humidity even when the temperature is lower than 70°, many times.

1997. How does that arise then?—I will put it in this way. It arises because the dampest portions of the sheds get wet floors, and weavers do not like that; but I find that nearer where the glasses are situated, perhaps, it does not seem as damp on the floors as it does in the damper portions of the shed; and it means this to me, that the dampest portion is practically at saturation sometimes when the other portions of the shed are still registering within the limits of the Act.

1998. Then there are sheds, portions of which are kept in a condition which is illegal?—Yes, but the glass does not tell that, because the glasses are not there.

1999. Then your contention will be that the Act is not observed in certain parts of the shed?—Yes.

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2000. (*Chairman.*) Have you any practical suggestion to make which would secure this particular portion of the Act of Parliament being better carried out; I mean anything that would give confidence to the workers that the readings were properly made and properly returned?—I do not quarrel with the readings not being properly taken where the instruments are placed. My suggestion to get over that point is to make the dampest portion the standard, and to put a glass there, to put an instrument there. The dampest portion of the shed is easy to find; it is generally nearest to the outside wall.

2001. (*Professor Lorrain Smith.*) Then we may conclude that in your opinion there would be no cause for complaint if the Act were observed, or, rather, if the schedule were laid down with limits such as you suggested?—I do not think there would. They might often come then, but we know the opinion of our people. We have to try and amend the conditions in the best way we can.

2002. (*Chairman.*) Half a loaf is better than no bread?—Yes.

2003. (*Professor Lorrain Smith.*) Still you do not think you have ground for going further than that, saying 72° and 67°, and if the hygrometers were placed in different parts of the shed sufficiently to give a complete indication?—I think myself it would do away with a lot of complaints that we receive, because I do not think it would be possible under ordinary conditions and keeping within the Act to work with damp floors then.

2004. (*Mr. Shackleton.*) I want to ask you one question which I think will throw some light upon it if you can remember the incident. There was a strike at Padiham some years ago. Was it before you were Secretary?—It would be at — in 1895 before I was Secretary, but I was implicated in it.

2005. If I remember rightly that strike was settled on the understanding that when the dry bulb got to 68° steaming had to stop?—If my memory serves me aright I think it was 64°, but I am not certain.

2006. It is really the principle I want to get at more than the actual degree. We will take it it was 64°. It was carried out?—It was carried out during that winter; that was all.

2007. Was there any complaint from the weavers afterwards about weaving worse after the steam was turned off?—To give you my impression at that time it was this: when we went back to our work after the strike —

2008. Were you weaving there at the time?—Yes, I was weaving there, and implicated in the strike. We were without steam altogether for three or four weeks. The goods we had in the looms at the time when the strike took place were sized for steaming, consequently we suffered with those warps. When those were woven out the steam was modified to a great extent when they did start using it, and we had very little complaint about bad work after.

2009. But there was another dispute, at —, was not there?—Notices were served, but I do not think they ever went out.

2010. (*Mr. Cross.*) Do you remember Corrigan—do you remember this instance—that there were meetings held with the Padiham employers, and the whole question of steaming in Padiham as a district gone into—do you remember that time?—Yes, that was during the settlement of —'s strike, and the agreement covered the whole of the town.

2011. It was before that?—Then I do not remember that.

(*Mr. Cross.*) It was in the time of your predecessor, Theodore Robinson.

2012. (*Mr. Shackleton.*) With regard to that point I want us to be quite clear, because it is about the only instance I know where an arrangement was come to by which steaming should stop at a certain point. I want you to give us clearly what the results were so far as weaving was concerned?—The result, as I have stated, was that we had to go back and weave the warps we had in the looms. Those certainly did worse without steaming. After those came out they sized the warps to meet the lessened amount of steaming, and there were no complaints about bad material.

2013. And you think that the weavers at that mill would have been quite pleased to have gone on with the 72° arrangement?—Yes.

2014. They would have been pleased to go on?—Yes.

2015. (*Professor Lorrain Smith.*) How long did that last?—The dispute was settled in September. We went to our work, and the 72° arrangement was stuck to during the whole of that winter, and until the following summer.

2016. (*Chairman.*) Why did they give it up then?—That is a point I cannot answer.

2017. (*Mr. Roberts.*) I suppose, being winter time, there was not much difficulty in keeping below 72°?—When you have heating with live steam and heating pipes as well it is an easy matter to raise the temperature to 72° in winter time. They could keep it down.

2018. Whereas, if it had been continued in summer time they could not have done it?—They could have stopped the steam.

2019. They did not steam in summer time by the heating pipes?—No.

2020. Even when they had stopped the heating pipes they could not keep down the temperature to 72°?—No, they could not.

2021. Therefore, they had to go on humidifying in summer time?—That is a point I do not know. I was not on the Committee at that time; I was simply an ordinary workman. Why the matter was let slide I do not know.

2022. You say that you wove the warps out after the steaming was stopped, and that they wove rather badly?—Yes.

2023. Because they were without humidity; but after those warps had gone out they brought fresh ones in, which had been sized specially?—To do with less humidity.

2024. Do you know that those were exactly the same sorts of cloth that they were making before?—Yes.

2025. Exactly?—Yes.

2026. The same amount of size had to be put on?—Yes, they were sized for weaving.

2027. They were not sized for weight?—No.

2028. I suppose that place is still steaming or humidifying?—They have the apparatus up for live steam, but I think they use it very little at the present time.

2029. We will take Padiham generally, as a whole; if you were to stop steaming in Padiham, how would wages go on?—They might suffer for a few weeks, but after that time I do not think there would be any difficulty at all. The bulk of our looms are on fine goods.

2030. And light sizing?—Yes.

2031. Therefore, in your opinion, if they were to size specially for this non-humid state of the atmosphere, they would weave equally successfully?—Yes, that is my opinion.

2032. (*Mr. Shackleton.*) I would like to follow up that question. Do you make similar goods in these mills at Padiham to what they do at Burnley?—I have no knowledge of Burnley. The majority of our looms are on from 50's upwards. You can practically divide them into halves. Taking the whole of the looms in the district, half below that and half above, and the reeds range from 50 to 132.

2033. There is another matter, that is in regard to water that is used for steaming. Have the weavers ever complained to you about the smells arising from it?—Yes, and where we find it in a mill at the present time we have to keep notifying the inspector. They find out that it must be so from the smell; they cannot see the apparatus, and I have seen the inspector once or twice on that point in one or two mills.

2034. You have never had any conversation with the employer as to why he stops it?—I have not.

2035. Does the inspector report to you that he finds things as you have said?—No; he only sends an ordinary acknowledgment, and says that it will be attended to.

2036. You only know by the change afterwards in the weaving shed?—Yes.

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2037. (*Chairman.*) Is the apparatus you speak of a double boiler?—Yes.

2038. In which they use town's water?

(*Mr. Cross.*) They do not use town's water.

(*Chairman.*) But when the apparatus is used they use town's water.

2039. (*Mr. Shackleton.*) The main supply of your water is from the river, is it not?—Yes.

2040. It is a very dirty one?—It is not clean.

2041. When was the last time you had a dispute about steaming in Padiham?—Two years since.

2042. (*Mr. Cross.*) What kind of humidification was that?—That was air driven through water with a machine at each end of the shed. The shed was eight alleys broad and 50 looms long.

2043. There was no live steam introduced in any way?—No; there was no live steam. These machines had a mouthpiece at the wall. The whole of the humidified air had to be driven through water and take steam up from warm water. I could not explain

the machine exactly, but it had to drive it the whole length of the shed to meet in the middle. There was a mouthpiece at each end, and the air had to make its way, without any trunks to distribute it, to the centre of the shed.

2044. What was the fault found with it by the work-people?—That it seemed to send water off near the ends of the shed, where the mouthpieces were; this water always seemed to be coming on to them.

2045. (*Mr. Shackleton.*) Still, you say they have modified that now? — They have modified that by putting trunks to the mouthpieces and carrying the humidified atmosphere throughout the shed.

2046. (*Chairman.*) Is it better now?—Yes, there are less complaints now than there were then, although they come occasionally now.

2047. (*Mr. Cross.*) Is it a German or an Austrian patent?—I could not say; but it is a foreigner. I could not tell you whether it is Austrian or German.

2048. (*Chairman.*) What is the name of the mill and the firm?— —.

The witness withdrew.

Mr. FRED THOMAS, called in and examined.

2049. (*Chairman.*) What is your office?—It is in Burnley, in Charlotte Street.

2050. I mean to say, what is your personal office: you are secretary of what?—Secretary of the Burnley Weavers' Association.

2051. Does the Burnley Weavers' Association include dry sheds and wet sheds?—Yes; about one-fifth are wet sheds and four-fifths dry sheds. That is what we had two years ago. We have less now.

2052. We might describe Burnley as a dry shed district?—Yes, generally.

2053. How long have you held your appointment?—I have been the general secretary over 13 years, and assistant secretary three years previous.

2054. Had you any practical experience?—No, only in dry sheds; I never worked in a wet shed.

2055. You worked personally as a weaver?—Yes; I was a weaver about 14 years.

2056. Always in dry sheds?—Always in dry sheds.

2057. Some years ago, you say, you had 18 sheds in Burnley that were under the Act?—Yes; two years ago we had 18 sheds under the Humidifying Act.

2058. I gather that there were a considerable number of complaints by the operatives?—Yes, they were scarcely ever off the doorstep.

2059. To what effect?—They were complaining not only of the dampness of their clothes, but also of the effect on their health.

2060. And a ballot was taken?—Yes, that is so.

2061. Would you tell us the method adopted for that ballot?—Yes. In the first place, we held a meeting of all the operatives employed in these sheds, and explained to them that we were going to take a ballot. The system we adopted was that one meal hour we distributed the ballot papers as the operatives went inside the shed, and the next meal hour we collected them as they were coming out. We did not ask for any names to be put on the ballot papers; but we did ask, as a guarantee that they would give us their numbers that they are known by in the shed, that is, their loom numbers, and the length of time they had worked in the steam, and we collected all those ballot papers and tabulated them.

2062. What was the result?—The result was that 4,359 weavers voted against steaming and 11 voted in favour of steaming. We gave a ballot paper, I may say, to every person entering, whether he was a weaver or even an employer himself; and the other persons consisted of 610 against steaming and one in favour of steaming; so that, practically, there were 5,000 against steaming and 12 in favour of it.

2063. Do you think that the majority of those operatives have ever worked under both systems?—Yes;

most of them. There are very few weavers in Burnley now working under steam but what have worked in dry sheds; in fact, I do not think there is a weaver that has ever worked continuously in Burnley in a wet shed.

2064. Have you considered the question from a weaving point of view—I mean, would the weavers generally think that the weaving is rendered more easy and more efficient by the use of moisture?—It is rather curious, but in proportion to the sheds, both wet and dry, we have more complaints of bad weaving from wet sheds than we have from dry sheds.

2065. And bad weaving, of course, means bad wages?—As a rule; they generally lose their wages.

2066. Can you speak with any certain knowledge as to which class earns the best wages—the weavers in dry sheds or weavers in wet sheds?—Unquestionably the dry shed weavers earn the most money.

2067. Is the Burnley trade confined to one particular class of goods?—Mainly: Burnley Printers.

2068. How do you describe the kind of goods?—We generally say about a 16 square is the average of the Burnley Printer—what we term 16 ends in the reed and 16 ends in the pick.

2069. (*Mr. Shackleton.*) Can you give the particulars of the sizing?—With regard to the sizing of a Burnley Printer, they do not put any surplus sizing on, but only sufficient sizing on to get the threads through the reed.

2070. (*Mr. Roberts.*) Light sizing? — Very light sizing.

2071. (*Chairman.*) Have you any knowledge of the different systems of humidifying?—Yes; I think we have three in Burnley. I think the names are Parsons, Hart and another one — I do not know whether there is a name to it, but it is blowing live steam out—steam jets.

2072. Which system do you think is the best of the three—which gives the least discomfort?—As regards the systems themselves, I am scarcely in a position to make a statement: in this sense, that every employer does not steam alike. What I mean is this: that some firms take particular care to see that the steaming is done in a scientific manner, and it does not matter what patent they have or what system they use, because they would probably take that care. On the other hand, there is one firm where there is a general diffusing of steam that plays skittles with the whole thing. Just before they take the reading of the wet bulb they dash water on to it, so that it may be then in a proper natural state as a wet bulb. That is done three times a day at a certain mill in Burnley.

2073. If they dash water, it would get over the so-called dry bulb, as well as the wet bulb?—I am not

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going to say that. My argument with the operatives is this: This water is kept in an oil can in the shed. This water is poured on to the wet bulb. The temperature of that water must be the same as the temperature in the shed. I think that is a scientific fact.

2074. (*Professor Lorrain Smith.*) Certainly. What conclusion do you arrive at from that?—The only conclusion I have come to is this: that they are experimenting with the whole thing.

2075. (*Chairman.*) Of course, it would depend very much on how long afterwards the reading was taken, would not it?—Yes.

2076. (*Professor Lorrain Smith.*) If you waited half-an-hour?—It is generally done about half-past six in the morning.

2077. You are merely wetting your wet bulb?—Yes.

2078. You have to do that in any case?—I have never seen that actually done. My opinion was that it would not have the slightest effect on the reading after a very short time.

(*Mr. Roberts.*) Unless they took it immediately, the next moment.

2079. (*Professor Lorrain Smith.*) Then it would not be accurate?—Some firms have not a special man appointed to look after a machine. Sometimes the managers, sometimes the overlooker regulates the whole thing.

2080. (*Mr. Cross.*) Is that common?—I should think it would be in about half the sheds now done in that way.

2081. (*Professor Lorrain Smith.*) What do you suggest about that?—Some of the other firms have a man that has some knowledge of it, and he has the confidence of the people. It is much better in those firms where it is left to somebody like that.

2082. You have fewer complaints?—Yes, we have fewer complaints with regard to wet clothes and excessive humidity, but uneasiness makes the operatives complain at those firms still about the steaming itself.

2083. (*Chairman.*) What about the heat of the sheds in summer?—They get up fairly well. In the best regulated mills (that is where there is steaming) I am informed it often gets to 85°, and up to 90°.

2084. (*Professor Lorrain Smith.*) By "often" you mean what?—I mean on a hot summer day.

2085. It would not be very often during the season, would it?—In summer time especially it gets well up.

2086. (*Chairman.*) I notice you say there is no process of a mechanical character in Burnley, so far as you are aware, for the cooling of sheds during the hot weather?—That is so.

2087. "This has been a sore point"—what would you suggest?—The total abolition, undoubtedly.

2088. I am talking of the heat in the sheds?—Do you mean where there is steaming going on, and a hot shed in summer time?

2089. Are you referring only to steaming sheds where the heat is complained of?—We get in both sheds heat. It is very hot sometimes in dry sheds.

2090. In steaming sheds you always have mechanical ventilation?—Yes, in that sense.

2091. And mechanical ventilation, if properly used, should do something in cooling a shed?—Yes, there is some operation of some kind for cooling a shed that I have never seen.

2092. In non-humid sheds you have no mechanical ventilation?—Except in one case an employer was telling me he did intend to put mechanical ventilation into that shed. That was — Mill.

2093. What do you suggest for bringing down the temperature in non-humidified sheds?—At one mill in Burnley they have no mechanical appliances, that is —; yet the operatives state that they are not troubled very much with overheating in summer time. The only system they have is the sliding doors at the top of the roof. They open those in summer time, and they say that they experience very little discomfort either with regard to draughts or excessive heat.

2094. I gather that they ventilate the mill by openings in the roof?—Yes.

2095. But supposing that it happened to be a very dry day with an east wind, would they be able to weave satisfactorily with those ventilators open?—At this mill they would, but at a lot of mills for Burnley Printers it has some effect on the warps undoubtedly.

2096. They would have to shut the ventilators?—Yes.

2097. Does not the air get very impure?—I have never had many complaints of that on a day when an east wind has been blowing; because it is rather a coolish wind as a rule, and the atmosphere of the shed does not get bad to that extent that you might expect on a hot summer's day. We have had very few complaints from operatives with regard to ventilation on a day when an east wind has been blowing—very few.

2098. You mentioned one firm, Messrs. —, Limited, — Mill, Burnley, No. 4 Shed, as being exceptionally well ventilated?—Yes, that is the one I have just been quoting.

2099. (*Professor Lorrain Smith.*) Do you say that you have no complaint about heat in summer in the dry sheds?—Yes, we have several complaints, even in modern sheds as well; they complain about the excessive heat on certain days in the year. When you get an atmosphere with a lot of humidity in and it gets rather high, the weavers complain about the uncomfortableness of the place.

2100. If it is dry heat they do not complain?—It is very seldom they complain.

2101. But take a dry summer heat, a temperature outside of 90° in dry summer weather, how do they get on in dry sheds then?—They begin to feel uncomfortable.

2102. Is there much difference in the wet sheds?—At the same temperature?

2103. On the same day?—In the wet sheds they say they are getting rather unbearable if there is any humidity at all in the atmosphere outside, and they are blowing the humidity into the sheds. Those are the days that they complain most of.

2104. When do they get unbearable—at what temperature?—Much depends on the constitution of a man, and much depends on the outside air; but they tell me when it gets over 80° it is getting uncomfortable in a wet shed.

2105. When does it begin to be troublesome?—At what time of the day?

2106. No; at what temperature does it begin to be troublesome?—Over 80°. I have never had many complaints on a warm summer day when the temperature has been under 80° in a wet shed.

2107. You described this vote to us in your district. What was the question put before them?—"Are you in favour of the total abolition of steaming in weaving sheds?"

2108. It has been represented to us that if a moderate degree of humidity and a moderate temperature were introduced there would be, comparatively speaking, no complaints?—That may be true. I would not like to say definitely; but my evidence goes to show this—at least, my experience does—that whenever a new shed is being built, and it is to be a dry shed, the applications from the wet shed weavers are so numerous that in one case an employer told me he could fill his shed twice over with applicants from wet sheds.

2109. You cannot give us any help, any definite guidance, about that point?—No; I have had no practical experience.

2110. One witness told us that with a lower temperature than you mentioned—that if the temperature was not allowed to go above 72° dry bulb and 67° wet bulb—he thought there would be practically no complaints?—I cannot speak upon that; except, it may be, in winter time, we do not find that the temperature gets up anywhere near 70°, even in a wet shed.

2111. Have you any complaints in the winter time?—We have not very many complaints in the winter time.

2112. That is a long way off total abolition?—Yes.

2113. Yet it is admitted it might be a good working scale?—It may be a good working scale; I cannot say definitely.

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2114. Total abolition, then, might be going too far?—We do not think so, because we have experienced both. You see, we have fully one-half the sheds now that do not steam that used to steam.

2115. Do you suggest that this scale I put before you would work quite well and would meet both sides?—I would not like to make a definite statement on that.

2116. (*Mr. Roberts.*) You said that you had worse weaving in the humidified sheds than in the dry sheds?—No; I said that we had more complaints.

2117. Are they the same style of sizing?—They are the same class of goods. I could not answer as to the style of sizing.

2118. That answers my question. Have you had serious complaints against the weaving from these humidified sheds?—Yes, very serious complaints.

2119. You have had several strikes: several during the last couple of years?—Yes.

2120. In Burnley?—Yes.

2121. Will you tell us whether those have been at humid or non-humid sheds?—Both.

2122. Can you tell us which had the most trouble?—It depends on what you mean by the word "trouble."

2123. They were all supposed to be alleging bad work, were not they?—Yes.

2124. Will you tell us which had the most trouble, whether they were humid or non-humid sheds?—The trouble was all alike. I do not quite follow the drift of your question.

2125. Had you more looms that complained about bad material in humid sheds or more looms in non-humid sheds?—In proportion to the number of looms in the town we had more complaints from the wet sheds than we had from the dry sheds.

2126. You are quite sure on that point?—Yes. We have a record of all the strikes.

2127. I mean to say, it is a question I could hardly have expected you to answer exactly?—The reason why I remember that so distinctly was because we went fully into that matter just at the time, and on that one occasion the whole of the complaints before our Committee with regard to alleged bad material were from places where humidifying was in operation.

2128. (*Mr. Cross.*) I understood that there had been changes from wet sheds to dry sheds?—Yes.

2129. Within a period of two or three years. Can you give us any recollection as to whether there were any complaints of loss of wages and increased work when the shed was changed from a humid shed to a dry shed?—Yes; in two or three cases, when the operatives asked the employer to abolish steaming he pointed out that he had sized his warps in order to run in the humidified system, and if they wished the system of humidifying to be abolished then for a short time—say, a week or two—they would feel the effects. They said they would be prepared to work under those conditions, and did so. But after that things seemed to work round fairly well; and I think we have only had two complaints—it may be three complaints—from these sheds since the humidifying was abolished.

2130. (*Chairman.*) To what effect?—Bad weaving.

2131. (*Mr. Cross.*) Can you tell us, have you any knowledge of how much the difference in wages was in that fortnight when they were working without humidity?—No, they did not give us any details.

2132. (*Chairman.*) In your district where humidity has been given up, have you ever known a request made by the operatives to go back to it?—No.

2133. Never?—No.

2134. (*Mr. Shackleton.*) I think you said in your evidence that one half of the sheds that used to use humidity had given it up as the result of the weavers' applications to the employers?—Yes, it is either nine or ten mills, and formerly we had 18 mills; so practically it is one half.

2135. As to the systems which were adopted in those nine sheds where humidity has been given up, were they live steam, or Hart's, or Parsons', or some other patent?—All the three kinds.

2136. So that your evidence applies then to steaming generally, apart from any particular system?—That is so.

2137. I want to get this on the evidence, because it is an important matter. This is a district where, up to very recently, we had no steam at all?—Yes, up to ten years ago.

2138. Ten years is a comparatively recent period in this business?—Yes.

2139. And there are now only some nine or ten mills out of the whole of the mills in Burnley where steam is used?—Where steam is used.

2140. What number of mills have you in Burnley?—120, roughly.

2141. In regard to these ten that now use steam, have you had any applications from the weavers at those mills in regard to the total abolition of steam?—Not since the general application two years ago.

2142. That is what I want to get at now. As to the ten sheds, can you tell us what the result of the ballot was at those ten sheds?—Yes, I have all the figures here. The first shed marked here that is now using steam is that of —, — Mill.

2143. What is the result?—Two in favour, 282 against; that is weavers.

2144. Give the best in favour of steaming amongst those?—The best is —, — Shed. Out of the total of 356 workpeople —

2145. Including everybody?—Including everybody—out of a total of 356 workpeople, three voted in favour of the steaming system.

2146. That is the best proportion?—That is the best.

2147. You can safely say if the Burnley weavers could have their own way there would be no steaming at all?—There would be no steaming at all.

2148. How do the wages at Burnley compare with other parts of the country on similar goods?—I should think our wages are in advance of any other town in Lancashire on those goods.

2149. Could you say that Burnley as a manufacturing centre has been fairly successful?—Yes, there is plenty of evidence to prove that.

2150. It has grown faster in proportion than any other part of the county in the last 30 years?—Yes.

2151. Except Nelson, which is a new town.

2152. (*Chairman.*) Do the same rates of wages apply?

2153. (*Mr. Shackleton.*) Yes, the same standard list is paid there.

2154. Whatever is made in Darwen or Blackburn would be paid in Burnley?—Yes.

2155. So far as the refusal of the operatives to work under steaming—and there has been refusal in many cases—it has not militated against the success of the trade up there?—Not the slightest. Perhaps I ought to make one statement here with regard to efforts being made to re-introduce steaming into one or two of these sheds. In one shed, the first on the list, last New Year's Day twelve months ago, in 1907, we had a very searching cold wind. I do not know whether you remember the morning or not, but I remember it very well now. Of course, Mr. — said it was a mistake, but at about twenty minutes to eight in the morning one of his taps was blown off—that is, live steam was blowing into the shed. As soon as the weavers saw the steam coming into the shed they all walked out into the street. Now that was the first time that there had ever been a strike at that mill. It was the first time we had ever had any serious grievance at the mill, and they declared definitely that they would not start work until he had cut that steam off absolutely. They laid down the condition that they would not start until he had taken out the apparatus. But he refused to do that. I told them that they could scarcely insist upon it, and ultimately they agreed to start work. No steam has ever been used in that mill since. Their average to-day is as good, if not better, than it was during the time they were using steam. Another case where steaming was used was a shed where Blackburn goods are woven, dhooties, where the percentage of size gets up to 60; that is —, Limited. They, at the request of the weavers, did away with steaming. The employers

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pointed out to the weavers that with that class of goods they might suffer in their wages, and asked them were they prepared to accept it. Yes, they said they were prepared to accept it. I think it is admitted that the average has gone down nearly 3d. per loom in consequence of that. The weavers know about it. They were asked only about three weeks ago whether they would be prepared to go back to the steaming, and they would not listen to it for a moment.

2156. Is that 3d. per loom per week?—That would be 1s. per week.

2157. Arising out of that statement, it is perfectly clear that the weavers appreciate the reduction of wages?—They prefer it to steaming.

2158. They know there has been a reduction of wages?—Yes.

2159. (Mr. Roberts.) In the Burnley district you have a certain width of loom generally, have not you?—Yes.

2160 & 2161. What width is that?—36 inches.

2162. 36 inch yard space. You also know that in other districts it is very much wider?—Yes, Blackburn.

2163. In Blackburn and Darwen it would be very much wider?—Yes.

2164. Can you give us any idea how much wider?—No.

2165. I may put it that in Burnley you weave principally 32 inch cloth and below?—And below.

2166. And in Blackburn they will weave 39 inch cloth and above?—I should think so.

2167. Considerably above, up to 56 inches; and not only that, but the sizing in many instances in the Blackburn district has to be made very much different to the sizing in Burnley on account of the style of cloth that has to be made?—Yes.

2168. Now, in the Burnley district they have in each warp, perhaps, 2,000 ends — that is a fair average?—That is a fair printer.

2169. But if you get into the Blackburn district they will have, probably, on an average, 3,000 ends?—Yes.

2170. Therefore, if the looms stopped exactly the same number of times in a day for broken threads, the percentage of breakages on the narrow cloth is very much higher than it is on the broad cloth?—Yes; on the law of averages, that is right.

2171. Apparently the narrow cloth can get on very much better in weaving?—Yes, we turn some stuff off.

2172. We have still to discover what natural humidity you have in the Burnley district; and whilst apparently you can possibly do without artificial humidity, it does not go to show because of your argument that they can do without it in Blackburn or Darwen?—I leave that for the representatives of those districts.

The witness withdrew.

Mr. WILLIAM NABB, called in and examined.

2185. (Chairman.) Are you secretary to the Bury, Radcliffe and District Weavers' Association?—Yes.

2186. How long have you held that office?—Between five and six years.

2187. Before that, what was your occupation?—Weaving.

2188. You were an operative weaver?—Yes.

2189. Have you worked in both dry and humid sheds?—I have only worked in dry sheds.

2190. You have no knowledge of wet sheds?—No; except from complaints that I have received at various times from the workpeople.

2191. In the district that you represent, what class of goods is manufactured?—We have various classes; we have the pure size and the heavy size. The heaviest will be rather over 200 per cent of size.

2173. But as to your own opinion? — I have no opinion in this case, because I have no practical experience in the matter.

2174. You will not say that because they can do without artificial humidity in Burnley they can do without it in Blackburn?—I would not go so far as to make any definite statement at all on that matter.

2175. (Mr. Cross.) You certainly have had experience in Burnley with regard to Blackburn goods and dhooties?—Yes, we have one firm.

2176. (Mr. Shackleton.) I want to ask a question arising out of the questions put by Mr. Roberts. The usual number of looms for a grown-up person in our district—Blackburn, Darwen, and all round there—is four, is not it?—I believe so.

2177. It is a common thing in Burnley for the weaver to have six narrow looms?—Yes.

2178. So that, although there would be more threads in a loom in our district, if you take the six looms against the four, they are about equalised?—That is about it.

2179. And the average wage which you spoke about would apply not as a bulk wage to the weaver, but the average per loom?—The average per loom is better from six-loom weavers than from four-loom weavers.

2180. (Chairman.) I intentionally omitted, when asking you questions, asking you about medical opinions, because I thought perhaps you could not answer with any definite knowledge as to the effect on health; but you have spoken of medical opinions. Now, would you be prepared to supply us with any evidence, coming directly from medical men, with regard to the effect on health?—The only evidence I can give you is this: that after receiving complaints, either of illnesses or deaths, which were commonly reported to be attributable to steaming, we have made an effort to see the medical gentleman or the medical attendant of those persons, and in casual conversation they have made certain admissions; but when we have come to pin them down definitely to a written declaration, or something of that description, they have cried off.

2181. Is there any medical man in your district who you think we should examine?—Yes; there is one; I daresay that he would be very pleased to come if he could get some statistics; but he says he has very great difficulty in getting them. He is Dr. —.

2182. Has he given special attention to this question?—Yes; he has had a fair amount of experience. He is in a district where steaming is in operation.

2183. (Mr. Shackleton.) On that point the Chairman has opened out a line of thought that it is best we should go on with a little. Is it a common practice for the weavers, in making reports to you and your Committee men, to say that medical men do tell them that it is advisable for them to get into a dry shed as soon as possible?—Yes, that is very common.

2184. That is a very common expression from the medical men?—Yes, as reported to us.

2192. Where are those mills found?—Right throughout the town. The — Mills is one, the — Mills.

2193. Is that in Bury?—Yes, that is in Bury, and the —, and the — Company; they have two mills, one in Elton and one in Bury.

2194. Are those all heavy size?—Those are all heavy size.

2195. Do they use humidity? — Yes, they use humidity.

2196. They are all humid mills?—Yes.

2197. What class of work is done in the dry sheds?—Printing goods—Burnley Printers.

2198. Is heavy sizing done in any dry sheds that you know of?—Not that I am aware of. There is one shed that has both pure and heavy size; but they do very, very little steaming at all. They do a little. The

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same class of work is woven in two sheds. In one shed they work practically without steam; but in one there is steaming. The same work is woven in one shed with practically no steam whatever, whilst in another shed what I term unnecessary steam is used. The overlooker turns the steam on.

2199. You used the word "unnecessary" steam?—I term it unnecessary there because the goods could be woven without.

2200. Are you of opinion that in some instances artificial humidity is necessary?—It may be to a slight degree, but, in my opinion, it could very well be reduced.

2201. In the manufacture of what class of goods do you think it necessary at all?—That will be chiefly in the very heavy size. Much depends then on the correct placing of the sizing.

2202. When you speak of very heavy sizing, what do you mean?—200 per cent. and over.

2203. Do you think that for satisfactory weaving purposes artificial humidity is necessary in all sheds?—I do not say in all sheds.

2204. You think not in all sheds?—No.

2205. Can you give us some idea in what sheds you think it unnecessary?—I worked in one shed myself where there has been a certain amount of heavy sized goods, and there has been no steaming at all. It is a pure dry shed. There was no steam whatever used.

2206. But, speaking generally, do you think that humidifying is necessary for weaving purposes?—Of course, that would depend upon the manipulation of the sizing; if they run too dry it may be necessary.

2207. Assuming that the size is manipulated right, do you think that in all cases artificial humidity could be done away with?—I do not say in all cases, but less steam.

2208. Can you give us some idea where you draw the line?—Of course, I think at any rate the schedule might be reduced in the third column, in the fourth schedule of the Act.

2209. We want to get at some practical opinion of that sort. Where would you begin to make alterations?—I may point out that I have been trying to get the records of the schedules in some of the sheds I have mentioned, but owing to the time when the letter came I could not. The schedule is changed on the first of the month—I mean that the paper is taken down on the first of the month. In this shed that I have spoken of, the figures are much below that which is permitted in the schedule; I mean with regard to the reading of the wet bulb. We have 59°–52°.

2210. (Mr. Cross.) Is that 59° temperature?—59°, and 52° the wet bulb.

2211. (Mr. Shackleton.) Is that a heavy sizing place?—Anywhere from 150 per cent. to over 200 per cent.; in fact, I know the sizers have said they have had to put as much as 250 per cent. on, and they did not know how they were going to get it. These are two distinct days. One was rather a damp day; the other was a dry day.

2212. (Mr. Shackleton.) Then what is the other figure?—The second reading on that day was 57°–52°, 60°–55°.

2213. (Mr. Roberts.) Will you just give us those readings again, please?—59°–52°; 57°–52°; 60°–55°. The next day it was 62°–56°; 62°–57°; and 64°–59°.

2214. (Chairman.) Was working going on satisfactorily then?—Quite satisfactorily.

2215. The weavers were perfectly satisfied?—Yes.

2216. I think you have said that you would not totally abolish steaming or humidification in some form?—No.

2217. Are we to take it that you would suggest a modification?—The same as I said if the work is run dry. With the sizing on the dry side it may be difficult; still at the same time in all cases I think the third column could very well be reduced.

2218. Have you had any complaints from the workers with regard to discomfort caused by humidifying?—Yes, we get those complaints of damp clothing, and complaints also of excessive steaming.

2219. What effect does it produce upon them do they say?—They say that immediately they get out in the air they feel chilly; that it brings about colds and bronchitis and rheumatism from the damp floors; through steam being introduced the water drips on the floor in most cases in our town. The steam is from a jet; the floor underneath is quite wet, and they are off work frequently with rheumatism.

2220. Can you refer us to any medical men who can give us any definite opinions?—I could not personally although the weavers have said to me that the medical man has attributed it to standing in dampness or on damp floors.

2221. The weavers themselves?—The weavers themselves have said that to me.

2222. Have you had any conversation with medical men on that subject?—No.

2223. Can you refer us to any medical men in your district who can give us any definite information?—I could give you the names of some I think. There is Doctor —, of Bury.

2224. (Mr. Shackleton.) Of course, you do not know what Doctor — would say, do you, or anybody?—No, I do not know, because I have not asked them who they have been to. The one that I did know who has made this remark was Doctor —, who has just gone out of practice. I do not know where he is now; he has given up.

2225. (Mr. Roberts.) He would be in Bury, I suppose?—No, he has left the town altogether; I do not know where he has gone to.

2226. (Mr. Shackleton.) Is he an aged man?—He would be about 48 or 50.

2227. How long has he been in Bury?—Towards 20 years.

2228. (Chairman.) Have you any suggestions to make which would improve the administration of the Act as it now stands?—The Act as it now stands, in my opinion, with regard to Section 93, is altogether inadequate. That refers to the visits of the inspectors. We get complaints, and of course the inspection is done at rather irregular periods. You could not get the inspector to do otherwise. We get complaints that after taking the record there has been more steam infused; then about an hour before taking a record again it has been shut off.

2229. Can you offer any practical suggestion that would improve this section?—Except by more frequent visits. The Act states that he must go at least once in three months, and does not say that he shall go any more.

2230. More frequent visits means more inspectors?—Certainly it would do that.

2231. More inspectors means more money for the taxpayers?—Yes.

2232. Is there anything short of that that you can suggest? I mean that simply to take a reading of a barometer one would hardly want a man to travel 15, 20, or perhaps 50 miles?—I do not know that I could suggest anything in that direction.

2233. Do you think that there is no one inside the mill who could be trusted to read a couple of thermometers and to record faithfully?—I daresay there are operatives that could be trusted to do that.

2234. Do you think that anyone should be deputed to do it?—In some of these places let me point out this factor: I do not know that it applies generally throughout the country, or throughout the county, but there are some employers who are chary about taking male labour; they prefer female labour; and I do not think you could get any female to undertake this work.

2235. There are always some intelligent men about in a mill, I take it?—Except they are really with us, you will not have much probability of inducing them to do anything on your behalf.

2236. Supposing someone were nominated on the part of the operatives to take the readings, and countersign them with the representative of the firm, would that give confidence that they were being properly read, do you think?—Would not it be possible that records might be taken outside the schedule time? To do that you would require someone who was practically inside

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the shed. We get complaints that after the record has been taken more steam is infused at irregular intervals till just before the recording of the readings takes place again.

2237. Then I take it you think that Section 93 should be more rigidly observed?—Yes, I do. If you have no objection to them, I have brought with me six certificates. We insist on the Registrar's certificate being supplied to us in all cases of death. I have taken these for 12 months, and have brought them with me if you care to examine them, because if our theory is right, bronchitis and phthisis have been to a certain extent brought about by steaming. I would like you to examine them, because I find that in 12 months that applies to 10 out of the 16.

2238. I think Professor Lorrain Smith would be very interested in them?—I have just brought them by chance. Prior to that we paid on a doctor's certificate.

2239. Is the occupation given of the people to whom they apply?—Yes. I have brought the whole batch.

2240. (*Professor Lorrain Smith.*) How many have you altogether?—Sixteen.

2241. (*Mr. Shackleton.*) Is that for 12 months?—Yes.

2242. (*Chairman.*) May we quote these—may we use these for official purposes?—Yes; it makes no difference to me.

2243. These will be returned to you. Now, will you just tell us about the ballot?—I have given you the figures there I think.

2244. I am now reading from your letter: "In order to clearly indicate the feelings of the weavers on this matter I give you the figures showing the result of a ballot taken of our members some 18 months ago. In favour of steaming, 167; against steaming, 916. The ballot was only taken of those members employed in steaming sheds."

2245. (*Mr. Shackleton.*) Have you any experience of those sheds previous to the institution of humidity?—I do not mean personal experience, but have any of your members worked in those sheds previous to the introduction of humidity?—I could not say, I am sure.

2246. Have they made any comparisons to you, in any shape or form, between one shed and the other?—I have had a comparison of those sheds. Some of our members have left the steaming sheds and gone to work in the dry sheds. We have one, whose name I have sent up, who will be able to speak for himself later on, I expect, who for some years when in a steaming shed was always troubled with bronchitis in the winter. Some fifteen months ago he went to work in a dry shed, and there have not been any symptoms whatever of it since.

2247. And the general feeling amongst your members is that they want to do away with humidification?—Yes, I think the ballot clearly indicates that.

2248. (*Mr. Roberts.*) I think you said, Mr. Nabb, that in these sheds, the readings of which you give, you had damp floors?—Yes.

2249. Had you a damp floor when it read 59°-52°, or during any of these readings?—I do not say there would be.

2250. No, no?—Of course, I did not ask that question, but we get complaints from these places of the damp floors, and those are about the ordinary readings; they are not exceptional; they are about the ordinary standard.

2251. You are suggesting that an alteration of this table would be advantageous. At these temperatures

the difference between the dry and wet bulbs is 2°, that is the allowance?—Yes.

2252. You get down to 5°, and even to 7°; would you want it altering still further than what you have said, because at those temperatures it would be impossible to have a damp floor?—That may be responsible for the method in which the steam is infused.

2253. Again, Mr. Nabb, what would be the effect on those sheds if you were to do away with this steaming altogether?

2254. (*Chairman.*) Might I suggest that the damp floor might possibly be due to some other cause, such as leakage in a pipe. We might ask him that.

2255. (*Mr. Roberts.*) Do you think it would be caused by a leakage of a steam pipe or of a water pipe?—In some of these sheds there are small jets from the main pipe from which steam is infused, and water is also running from the pipe on to the floor.

2256. That is defective apparatus. That has nothing to do with humidifying at all. Will you answer this question: What would be the effect on the weaving in the trade that you represent, where you have 200 per cent. sizing, if you were to do away with steaming altogether?—Not having been in a humid shed, it is difficult to say.

2257. You have told us what your weavers have told you about many things. What would your weavers say to that?—They have balloted in favour of abolition.

2258. Do they know that their wages would go down, and are they prepared to suffer that loss of wages?—Of course, the whole matter was clearly placed before them when the ballot was taken. They knew their own position; they knew whether with or without steam the manufacture could be carried on.

2259. At present you do not know whether they are aware that they would suffer loss of wages?—The question was pointed out to them. I think that would be quite clear enough. They knew their own circumstances at their own particular mills.

2260. In your evidence you stated also that you had a shed in your district where they are heavily sizing without artificial humidity?—I did not make quite that remark. I think you have misunderstood me. I gave one instance where the same class of work was being woven in one shed without practically any steam—with very, very little steam at all—while in another shed steam was being infused. My idea in that is that steam is being infused sometimes where it is not necessary.

2261. (*Professor Lorrain Smith.*) One question I have to ask you, Mr. Nabb. Are these certificates regarding people who have been working in humid sheds?—I do not say that they are all humid sheds; it is impossible for us to say; only I say if steaming has any effect towards bringing on diseases, then that is what I have brought them down for.

2262. I want to know whether these individuals were working in humid sheds?—We might be able to get to know.

2263. (*Chairman.*) Then will you take these back, and distinguish between those who worked in dry sheds and those who worked in wet sheds. Unless you can differentiate them they will be of very little use?—You want me to ascertain whether these people worked in humid sheds or not?

(*Chairman.*) Yes, and for how long.

The witness withdrew.

Mr. JOHN FARRON, called in and examined.

2264. (*Chairman.*) What appointment do you hold now?—Secretary to the Rossendale Weavers.

2265. Have you held the appointment long?—About fourteen years.

2266. And before that what were you?—I was a weaver previous to that.

2267. For how long were you a weaver?—From being about nine years of age up to about 36.

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2268. What class of work is done in the Rossendale district?—Nearly all plain cloths, Ts, shirtings, domestics.

2269. And what sizing is done as a rule?—We have both sorts, but mostly heavy sizing.

2270. And, approximately, how many mills have you in your district?—Twenty-seven, taking hard waste—all included.

2271. Generally speaking, are they humidified mills or are they dry sheds?—About half and half, taking all in.

2272. Is the same class of goods made both in the dry and the humidified sheds?—In the humidified sheds they are mostly heavy-sized goods.

2273. That means that humidity is generally introduced into the heavy-sized mills?—Yes.

2274. Are there any pure size or light-size mills where humidity is introduced?—Yes. I had better refer to some notes. We have but very few, and they are mostly hard waste places, where no steaming is used; and then we have about three places that do not use steam that are on light goods. None of the hard waste places use steam. Hard waste is cotton waste.

2275. You know, of course, that there has been a great deal of discussion about humidifying in weaving sheds?—Yes, there has during all my time.

2276. I suppose you have considered the question from these various points of view?—As a worker, having worked in both classes of sheds, and then being the secretary for the weavers for 14 years, of course, I have heard both sides and considered it.

2277. Take it first from a weaving point of view; then afterwards I will ask you some questions about the comfort and health of the workers. From a weaving point of view, do you consider that humidifying renders the weaving easier or better?—In light-size sheds I do not think there is very much difference betwixt having humidity and being without it. In our district they get along without it. Up to being 22 years of age I wove in a shed where perhaps about 50 per cent. of size was used, and in that shed we never had steam and no system of humidifying.

2278. Was that at Ramsbottom?—That was at a place called — in the Ramsbottom district. The same manufacturer removed to —. At that place he went in for all light size, and he had no steaming whatever in that place. That was in my weaving days. Then after that I wove in places where they had a great deal of steam. Those were mostly heavy-size places. For weaving light-size goods we got along all right without any steam. The heavy-size goods, of course, the steam did assist somewhat.

2279. The steam assisted the heavy-size goods?—Yes.

2280. You know that in some quarters it has been proposed that artificial humidity should be prohibited by law?—Yes.

2281. What do you think of that proposal?—Weavers in our district, if that question were put to them, would almost unanimously go in favour of prohibiting it. That is my opinion from conversation with the weavers: that they would go in for prohibiting it—in the heavy-size sheds that is.

2282. In all sheds that is?—Yes.

2283. Do you know if they have ever tried in the heavy-sized sheds to work without humidity?—I do not know a shed that has since I became Secretary up in our district. They have always used steam.

2284. Is not it just possible, supposing that the steam were turned off in those sheds, that they might ask for it to come back again?—Well, it is possible, though I very much doubt it, for this reason: that we find that when steam is being used there is always a large number complaining that they are getting too much steam. There are a number of warps besides that will be damp, and a number that will be dry, till nobody is ever pleased; that is to say, you do not please all of them when steaming is going on, and steam is being blown into the shed—you never please all the weavers; you have always a number dissatisfied that want it turning off.

2285. Would they be satisfied if it were turned off altogether?—That would be best told after trying it.

You see when they can have steam there are a number that have dry warps in, and they fly to steam right away; it is convenient, and a thing that is most convenient we go to. But if they could not have the steam, my opinion is that they would get along without it.

2286. Would the output be as good?—It would depend somewhat on the sizing of the warps, how the manufacturers sized them. I would not say that it would be. It might not be so on some classes of cloths, but taking it all round, I do not think there would be much difference. It would be very little different; that is my opinion.

2287. Do you know the different systems of humidifying?—In our district we have mostly steam. We have only two mills that use other systems. One is —.

2288. (*Mr. Roberts.*) It is a water-spray system?—Yes. Then we have another, an Ashton-under-Lyne patent. I do not know the name of that, only that an Ashton-under-Lyne firm put it up.

2289. That is Hall & Kay's.

2290. (*Mr. Shackleton.*) Trunks?—Yes. There are only those two that I know of. The others are blowing steam off into the sheds.

2291. (*Chairman.*) In your opinion, which is the better system?—We have less complaints from those where there is a system of humidifying without steam.

2292. (*Mr. Shackleton.*) That is from the first one you mentioned?—Yes.

2293. (*Chairman.*) Have you ever noticed in the very hot weather whether the system of humidifying with cold water tends to bring down the temperature in the mills; I am assuming in the summer it would be absolutely cold water?—Perhaps that is so. We have one mill in our district, a very noted mill, where the heat would get up to over 90°. It lies low; and since they did away with steam and started with humidifiers there have not been quite so many complaints. It is a noted mill where the temperature used to get up to between 90° and 100° in the weaving shed, and with steam blowing off in a place like that it was simply unbearable. The weavers have had to be carried out because they fainted in the alley.

2294. (*Professor Lorrain Smith.*) You could not tell us what the wet bulb stood at?—No. They have done away with steaming and have humidifiers.

2295. (*Mr. Shackleton.*) What kind of humidifiers?—An Ashton-under-Lyne patent. Would there be any objection to my giving the name of the mill?

2296. No?— —, — Mill.

2297. (*Chairman.*) Then we take it from you that the operatives would like to see humidity done away with?—Yes, I feel certain if you were to take a vote on it they would.

2298. You understand that I express no opinion whatever as to whether that can be carried out or whether it cannot be carried out; that is for the Committee to decide hereafter; but we will say, for the sake of argument, that for practical reasons it could not be carried out on the whole: could you suggest any modification of the present law which would improve matters for the workers?—We get most of the complaints during the summer months, say in June, July and August, and the heat in the sheds gets anywhere from 70° to 90°. With steaming at that heat no one can work in it with comfort. That is my own experience. I have worked in it, and I know what I am talking about. To have steam blowing off when you have over 70° of heat—well, it becomes unbearable in it, and no man can work in it with comfort. That is my opinion, and if after a certain heat we could compel the employers to cool the sheds in the hot months by having some system of cooling, I do not think there would be so many complaints over steaming as there are. It is hot in the summer months in our district.

2299. According to this paper you were good enough to send to us, you seem to be of opinion that the present Act allows too much humidity, and that the law is not carried out?—Yes.

2300. I suppose you mean by that that the limits are exceeded?—I do.

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2301. And, even if the limits are not exceeded, that there is not a sufficient limit?—Yes, my opinion upon that is this: The floor is often black wet, and the overlookers have taken sacks with them when they have had to go on to the floor, and they have laid the sacks on the floor for them to go down upon when they repaired the looms; and, notwithstanding this dampness, we have the steam being blown off and humidifiers. I say that with the floor black wet the overlooker, in order to lie down to repair the looms, puts a sheet on the floor; yet the hygrometers are registering all right—so they say. Then, in other cases, where they have sent a young man or a boy to take the record he has gone to the hygrometer, looked at it, and gone away without taking a record; the steam has been turned off, and he has come back in 20 minutes' time and taken a record. That report has been brought to me repeatedly by the weavers: that he has gone and looked at it, gone back into the warehouse, and then, in about 20 minutes, after the steam has been turned off for 20 minutes, and given the hygrometer time to go down, he has come and taken the figures. That is proof to me that it must have been too high.

2302. That suggests that the readings in some instances are not accurate, and not faithfully taken?—Not faithfully taken.

2303. (Mr. Higson.) You suggest that they wait until it is right?—Yes; I should say they are faithfully taken, but they wait until it is right.

2304. You do not suggest there are wrong figures put down?—No.

2305. (Chairman.) Does not the Act say that they shall be taken at certain times?

2306. (Mr. Roberts.) It gives you the hour—between 11 and 12.

2307. (Witness.) And seven and eight or three and four. I do suggest that during that hour it has been more than it ought to be. It has registered higher than it ought to have done; they have refused to take it then, and come a second time.

2308. (Chairman.) Can you suggest to the Committee any means by which the readings could be taken in such a way that the operatives would have confidence in them, and would feel that they were being truly recorded?—I am not suggesting that they are not truly recorded now; but, as I said this morning to another witness, there are careful men and men who are not careful in every trade and every business, and it has been suggested to us that sometimes the operatives think that the records are not quite reliable: can you suggest to us any way in which they could be taken which would command the confidence of the operatives?—That is a difficulty. I cannot suggest just how they should be taken. Of course, the operatives have reported to me when they have been wrongly taken. Still, I could not suggest that the operatives must take them themselves. I cannot answer that.

2309. The inspector is supposed to take observations once in three months; but assuming that his duties allowed him to do it once in three months, once in three months seems a very small check upon something that is going on every day, and all day?—Of course, if they could be visited oftener, that would be a much better check.

2310. It strikes me that it need not necessarily be an inspector, who has to travel perhaps 50 or 100 miles to take the readings of two thermometers, that that might be done by somebody on the spot?—If some disinterested party could go in when he thought fit and look at the hygrometers, then we could get at this thing, and see if there was too much humidity being put in.

2311. To put it in plain language, these complaints are made very often by the operatives?—Yes.

2312. Is there any reason why an operative cannot himself read the thermometer?—With a little instruction, the operatives could do that, I should say. Of course, I do not think many of them take any notice; some of them do.

2313. I am quite aware it might be suggested if an operative kept on looking at the thermometers that the manager might have his eye on him, and say that he was making reports, and that sort of thing; but

could not someone be authorised, and have a legal authority with the management of the mill to look at the thermometers and put his name to the register?—Someone who works in the mill?

2314. Someone who works in the mill; could not he do it on behalf of the operatives?—I do not know.

2315. (Mr. Shackleton.) Have you a system of mill representation in your district?—We have a committeeman for nearly all, but not quite all the mills; we have about 18, and for a few of the smaller mills we have not. For most of the steaming mills we have. Of course, if the worker could feel confident that he would not be victimised on account of doing anything of that sort, he would do it; but he would want to feel satisfied.

2316. On behalf of the manufacturers, somebody is obliged to do it, and put his name to it; why should not someone on behalf of the operatives be obliged to do it, and put his name to it?

2317. (Professor Lorrain Smith.) If the Home Office refuse to take the records except they were signed by such a person, it might be a way out of the difficulty.

2318. (Chairman.) Of course, it would have to be done by legislation. I confess I cannot see why that difficulty cannot be got over. You say "The opinion of workpeople in our district is that they suffer in health in consequence of the steam going into the sheds, and we find they prefer to work in a shed where steaming or humidifying is not practised"?—That is so.

2319. Have you any medical statistics which would show the comparative health of people working in dry and in wet sheds?—No, I have nothing of that kind. We have only this: that the weavers always prefer to get to that shed where there is no steam; and oftentimes they will sacrifice something in wages to weave in a shed where they are not using steam.

2320. (Professor Lorrain Smith.) I gather that it is the temperature that you attach most importance to; you guide yourself by the temperature?—In summer time that is so. We have more complaints during the hot summer months than in any other period of the year.

2321. The temperature is more complained of than the dampness which you get in the winter time?—I do not know. We have a lot of complaints of the dampness, especially of the floors.

2322. I want your opinion?—The complaints would not be so numerous if during the hot summer months there was not steam being blown off, and the floor black wet.

2323. Is the floor wet in summer?—It is worse in summer than in winter. It is summer time when the complaints come of the floor being black wet.

2324. Then they dislike working in those conditions?—They dislike that especially.

2325. That is very much complained of—the dampness of the floor?—Yes. Then, for instance, there is another practice: they go to the mill first thing in the morning, say at six o'clock; there has been very little steaming in, then they begin to blow steam off; the whole shed is filled with it, and the weavers cannot see 10 yards beyond their own looms for it. The whole place is filled with steam, and it is settling on their clothing and everything. No doubt the hygrometer does not register it high then, but still the place is completely full; there is a great fog of it. The place has been allowed to get dry in the night time, and first thing in the morning steam is blown in for half an hour.

2326. (Mr. Roberts.) What percentage of size have you at this place?—From 100 per cent. up to 200 per cent. They make heavy Ts and shirtings, and that class of goods.

2327. What would be the effect on the weaving, supposing the whole of this humidity was turned out?—Of course, in the first place the employers would try to adapt themselves to it in their sizing, for instance.

2328. But leaving that on one side?—Leaving that out altogether, and using the size they do at present, there would be some loss in wages no doubt.

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2329. How much would there be do you think?—Perhaps five per cent.

2330. Only five per cent.?—I do not think there would be any more.

2331. What are the wages now, roughly: do they get 6s. on an average?—In a full week perhaps their average would be 5s. 8d. or 5s. 9d., not 6s.

2332. You think it would only drop about 3d. a loom?—I do not think it would drop more.

2333. Would the weavers put up with that amount less in wage if they could get the total abolition of humidity?—I think they would, till such time as they could get it back.

2334. Get it back in what way?—In the sizing being adapted to the conditions under which they had to weave.

2335. Supposing the masters could not adapt the sizing?—If they could not they could not, but my opinion is that they can.

2336. Supposing they could not, what would be the effect?—The weavers would have to suffer the loss, and it would be worth it even if it were 10 per cent., from a health point of view; that is their opinion, that from a health point of view it would be worth it to be without the steam.

2337. Is that your opinion?—That is my opinion too. Of course, I know they argue that a certain amount of moisture is necessary, but when the floor is black wet, and your brush comes, as it does twice a day, and you cannot rub it over the floor—that is, you cannot get your brush over the floor to sweep it because the floor is so damp, and you are told that they are not exceeding the limit of humidity, it makes one suspicious.

2338. Do you say that your weavers would be satisfied to work with 10 per cent. less in wages to do away with this artificial humidity?—I mean to say it would not be 10 per cent.; but if it did come to be 10 per cent., they would, I believe, prefer to be without steam.

2339. (Mr. Higson.) You mean steam in excess?—Of course, it generally gets to what we think is excess. If they would do it in moderation, perhaps there would not be many complaints.

2340. You speak about the shed floor being black wet. Have you ever seen a shed floor black wet in a shed that is regarded as a dry shed?—Not very often; you might occasionally in very moist hot weather.

2341. We have dry sheds with the floor black wet oftentimes in November?—It has not been my fortune or misfortune to work in those places.

2342-4. Were those floors black wet in those sheds that you worked in as you have been representing now?—Yes, time after time I have seen it.

2345. In the shed you were working in?—In the shed I worked in when I was weaving.

2346. You attribute it all to steam?—It was in steaming sheds.

2347. You attribute the black wet floor to the steam?—Mostly.

2348. Would it have been black wet if there had been no steam in, do you think?—I do not think so.

2349. It often does happen. You know the condition and situation of weaving sheds, and the kind of earth upon which they are built, and all that sort of thing renders lots of floors black. We have a shed and half of it is black to-day, and the other half dry as a bone?—You would not want to aggravate that black wet floor by blowing steam in.

2350. I should be very glad if it were all black. We have half of our shed black to-day, and the other half is dry; it all depends upon the kind of earth on which it has been built?—My complaint is that when the floor is black wet they are still blowing steam off. Why should they?

2351. (Mr. Roberts.) Because they have not sufficient humidity in the atmosphere.

2352. (Mr. Cross.) Have you had any particular complaints with regard to illnesses that the weavers have that they think has been caused by this excessive use of steam you refer to, or steam at all?—Yes, especially rheumatism.

2353. Have you had many cases under your observation or within your knowledge?—I have had a number since I went up yonder, people who have had to stay off work owing to rheumatism, which they attribute to dampness from steam.

2354. How many do you think about, as an approximate number?—Of course, I am speaking from memory; I should think a dozen. I have not kept a record of them.

2355. (Professor Lorrain Smith.) None in any of the dry sheds?—Of course, we have rheumatism even there, but not so much as in the other sheds.

2356. (Mr. Cross.) You attribute those dozen cases to working in wet sheds?—Yes.

2357. That is outside of any others at all?—We have weavers of that character who have given over and left those shops and gone to dry sheds at a sacrifice in wages.

2358. By whose advice, or has it been on their own initiative?—It has been on their own initiative. They have thought it has been on account of steam blown off, and they have given it up.

2359. Has any complaint been made to you of any evil smell from the steaming? I suppose you have had the old steam jets?—Yes.

2360. The old form of steaming. Have you had any complaints about evil-smelling steam anywhere?—We used to have; we have not had so many lately. We have one mill now that we have had complaints from not very long since over the water smelling or the steam that is blown into the shed. We used to have very many of those complaints five or six years since. We have not had so many lately over the water smelling.

2361. To what do you attribute the change?—Some that used to take water out of the mill lodges have got fresh water.

2362. Fresh water boilers?—Yes.

2363. (Mr. Shackleton.) What was the result of the ballot you had recently in your district, eighteen months ago?—I cannot give you the number, but it was an overwhelming majority in favour of abolition of steaming. I cannot give you the exact figures.

2364. (Mr. Cross.) Have you a fair number of male weavers in your district at these heavy shops I am speaking of—are they equal numbers or more men?—More females.

2365. Even in those heavy shops?—Yes, two-thirds are females at least in the heavy shops, I should think.

2366. (Mr. Shackleton.) You have absolutely no doubt about the opinion of your weavers in Rossendale about this steaming, then?—I have not. I feel certain that if we tested them on that question whether they were in favour of doing away with steam, it would be nearly unanimous.

2367. Even at a reduction of actual wages?—If they were asked would they have their wages reduced and do away with steaming they would want to know to what they were being reduced; but they would prefer to risk their earnings and do away with steaming.

2368. (Mr. Higson.) In weaving sheds wherever there is less wages there is more work done, is not there—that applies all through?—That applies generally.

2369. Do you think these weavers would be satisfied to be without moisture altogether and sacrifice 5 per cent. or 10 per cent. of their wages and work harder besides? You ought to think carefully about that. Would they be satisfied to abolish moisture altogether, work harder, and have a less wage?—Of course, that is putting it as black as you can. Of course, I believe if the question were put to them: Are you prepared to abolish steaming altogether they would say yes. The assumption is that they will risk their earnings. Now it would not be fair to say to them: Will you do away with steam, will you have 10 per cent. less in your wages? We are assuming that the wages would be less. I do not think they would. But the operatives would risk any reduction of wages to do away with steam.

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2370. Have you ever put it in that way to them? How much does it reduce the wages when you turn steam out of a shed where it has been the habit to use it?—I do not know; we have not been in that fortunate position that they have taken steam out; they have generally had it in. Only whenever they get too much in the shed have they turned it out. They generally work as near to what they are allowed as possible, and leave it at that.

2371. This is all hearsay of yours; you have not been in sheds to look, have you? You say they work as near to the limit as possible?—I get the reports from the people who are in the sheds.

2372. (*Mr. Cross.*) Have you ever been in any of these sheds with regard to any matter between the employers and the weavers which was mutually agreed upon, and have you been in any mills where steam has been infused?—I have been into nearly all the mills in our district, but not on this particular question of steam.

2373. Have you seen these floors in the condition you have described yourself?—No, I have not noticed that, because I have not gone in for the purpose of the steaming; it has been on other matters, and I have not noticed. I would not like to go any further than what I really know.

2374. (*Mr. Shackleton.*) Your only opportunity of knowing is from what the weavers tell you?—That is so.

2375. You have no right of entry?—That is so.

2376. You simply take what the weavers tell you?—That is so.

2377. (*Professor Lorrain Smith.*) I do not know whether I got clear from you this point: Supposing you were not abolishing humidifying altogether—supposing its total abolition was not a thing recommended; what modification would you suggest as a practical man of the present schedule?—I would say this: that after the shed got to such and such a heat there should be no steam whatever blown in.

2378. Give us the heat, and give us the amount?—The most comfortable time of the year, when we have

least complaints from the operatives, is spring and autumn. Betwixt the months, say, of April and May, we get very few complaints. In June, July and August we are inundated with them. Then, when we get to September and October again, we have very few complaints. It is heat combined with moisture that seems to prove so unbearable. Beyond 70° I would have no moisture whatever, no steam blown in.

2379. 70° dry bulb. What would you make the wet bulb: according to the schedule it would be 68°?—There is about 2° difference.

2380. What would you make it—would you leave it at that, or would you care to modify it?—I would not have any steam blown in; I would leave it to the atmosphere itself. I would not have any steam blown into the shed after it got to 70°; none whatever; it would have to be the natural state of the atmosphere, whatever it got to. After 70° I would not have any steam blown in, because you must add heat to the shed if you did.

2381. Will you suggest any temperature, or any modification of this scale?—You see it runs from 70° away up to 100°.

2382. (*Chairman.*) Is not it a wrong assumption that you must add heat if you get any humidity in; because many witnesses have suggested that by putting in a cold spray you would bring the temperature down?—I said steam. I referred to steam.

2383. (*Professor Lorrain Smith.*) The next point is, how would you regard this question of the temperature if over 70°. I notice you attach great importance to the heat?—I do not say that where they use some other system apart from steam they might not do it. It might be possible to cool the shed with that.

2384. There would be no objection to that?—I do not think there would be any objection; but blowing steam off into the shed I should certainly object to after it got to 70°.

2385. What temperature might we go to, supposing we were blowing in cold vapour by one of the humidifiers?—I am not an expert; I would rather not say.

The witness withdrew.

Mr. JOHN W. OGDEN, called in and examined.

2386. (*Chairman.*) What official appointment do you hold?—I am Secretary of the Heywood Weavers' Association.

2387. How long have you been Secretary?—Seventeen years.

2388. Before that were you a practical weaver?—Yes, from being about eight years of age.

2389. Do you state that steaming or some system of humidification is in vogue in twelve mills in Heywood and the district?—Yes.

2390. And the class of yarns used average twenty-eights to thirty-sixes?—Yes, that is about the average.

2391. Yours is not a heavy-sizing district?—No.

2392. And you state that the heavy size is about 30 per cent.?—Yes, I should think that is one of the heaviest.

2393. And the average is about 25 per cent.?—Yes.

2394. I understand that there has been a strong feeling on the question of artificial humidity; the workers are of opinion that it causes them inconvenience or that it injures their health?—Yes; they always have that feeling more or less, more especially when it comes in warm weather.

2395. In warm weather you feel it most?—Yes, we get it then more acutely.

2396. You had a ballot of the workers as to whether they were in favour of steaming or against steaming?—Yes.

2397. That ballot took place in twelve mills?—Yes.

2398. The result in favour of steaming being 44?—Yes.

2399. Against 1,642?—Yes.

2400. Neutral 60?—Yes.

2401. Number of looms 5,400?—Yes.

2402. You stated in favour of steaming or against steaming?—Yes.

2403. By steaming, do you mean the introduction of live steam into the shed, or does the term as it is here used include humidification of any kind?—For the purpose of that ballot we said steaming or humidification.

2404. Then you think that the workers are against the introduction of humidity in any form?—They appear to be so from what we can gather, though our system is chiefly steaming with live steam.

2405. Can you tell us in how many sheds the live steam system is found?—Practically in all those twelve sheds.

2406. Your workpeople appear not to have had much experience where a system of water spraying is used?—I do not think we have had much experience of that.

2407. You complain, I think, greatly of the heat in summer?—Yes.

2408. Do you think that by substituting, say, a water spray for live steam when the temperature rises beyond a certain amount that the temperature of the shed might be brought down?—It might have that effect, though I do not know that that would be satisfactory to the workpeople myself. I do not think that would be satisfactory to them. I believe in one shed we had they tried something of that kind, and have gone back to the simple method of live steam. I think that was the shed called the — Mill.

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2409. And I gather that you think that they suffer in health?—Yes, they think they do.

2410. You have forwarded, and I propose to read these letters to the Committee at a later stage, certain medical opinions on that point?—Yes.

2411. From a weaving point of view, do you think that the work is better done where there is a reasonable amount of humidity?—Well, it all depends on your premises, you see. If you put material in that you know will not weave without a certain amount of humidity, it is better done, because it must naturally be so. But if we get yarns that are not what we consider heavily sized, we claim we can weave them far more easily with the ordinary atmosphere without humidity. We have several sheds where there is no humidity or steaming whatever.

2412. You probably realise that it would be extremely difficult for any committee or for any Government to say to any manufacturer, You shall only use certain yarn?—Yes, if they were to specify certain yarns.

2413. I mean to say to start with, no Government officials I take it would have technical knowledge to dictate to a manufacturer or weaver that yarn should be used?—No, I should only expect the Government to say, we have no cognizance of the yarns themselves, but we think that the conditions occasioned by steaming or humidification are not healthful to the workers and are not conducive to their best interests: we object to that—and then leave the rest to the employers themselves and to the trade generally.

2414. The effect of that possibly might be this: I only put it to you for your opinion. We must assume that if these cloths are made of certain inferior yarns there is a demand for those cloths?—Yes.

2415. If the manufacturer had to put in a better class of yarn he would have to raise his prices?—Probably, yes.

2416. Do you think there would be any danger of our losing that trade?—No, not ultimately, because the people would have to have clothes at the finish, and they would be of better cloth probably.

2417. Could not they be got from countries where there are practically no regulations at all?—This demand would be supplied by other countries, you mean?

2418. Yes?—We should have to face that probably. We have to put against that fact that sheds in other districts are carrying on the work without steaming.

2419. With inferior yarns?—No, I do not say that. The fact that they use better yarns probably enables them to do without it.

2420. You are not able to say whether they can sell their goods for the same price as the people who use steam?—No, I am not able to say that. I do not know exactly what they get for the cloth, you know.

2421. You speak of the bitter complaints about the heat in summer. Could you give us any practical suggestion for improving that?—No, I could only say this: that we think it is quite hot enough without any artificial humidity going in whatever. Of course I know it is assumed that humidity really lowers the temperature of the atmosphere at any rate; but the practical experience of the workpeople seems to be that it aggravates it, that it makes the natural heat far worse to bear; and we prefer to stand by that and take our chance. We know the natural heat in summer is very great, and we claim that it makes it far more oppressive and overbearing. Of course a means of reducing the ordinary temperature would be by white-washing the windows as they do now.

2422. You state that your view is that do what you will you cannot steam warps without steaming the clothes that the operatives wear?—Yes.

2423. Do you mean the clothing that they are actually wearing at the time or the clothing that they take off?—The clothing that they actually wear. Supposing I were a weaver, I take my jacket off. If steaming has any effect at all it has to humidify that warp that the weaver is about all day, and if it humidifies the warp you cannot prevent it humidifying the clothes that the weaver is wearing.

2424. According to science, unless the dew point is reached there should not be a deposit of moisture?—

No, but of course we have against that that you can go and put your hands on the pillars and scrape off the moisture, and on the walls of the sheds and on the floor. In our district now they are actually putting boards down for the people to walk on because the floors are so damp. We consider where that is existing it must be detrimental to the health of the people working. The dew point must have been reached there.

2425. It is on the pillars, you say?—Yes, and on the floor and so on.

2426. That is where a condensation would go on. Do you know as a matter of fact that the workers when they go home feel their clothes damp: suppose a woman worker is working in a blouse or a man in a shirt: when he leaves if he puts his hand on the shirt or the woman puts her hand on her blouse would it be wet?—I should say after a certain time it would feel clammy after leaving work. Of course when they got home to have tea they would sit by the fire, and it might have a chance of drying a bit.

2427. You state that your experience is that steaming has not improved the weavers' average earnings?—Yes.

2428. You believe in the ultimate extinction of the system?—Yes.

2429. By which I mean that you would not do it all at once?—I feel influenced somewhat by the argument you used a short time ago as to the trade, that they might say it was unreasonable, and if there is a certain trade which has been created by supplying a certain demand I would give that a little bit of time to adjust itself if possible. That is my meaning there: I would give the trade a time to come round to the conditions.

2430. Of course we have to bear in mind this: that in every civilised country or perhaps uncivilised country in the world that I know of you will find humidity in some form introduced?—Yes.

2431. We cannot conceive that all these people all over the world are wrong. If they go to the expense of putting in this plant, which is very costly, they would not do it unless there is some advantage to be derived from it. I do not say that it is necessary for all classes of goods, nor do I suppose for a moment that it should be done out of reason, but you talked about ultimate extinction. Can you suggest any method which would now take the place of humidity?—We take the stand of course that we are prepared to risk the natural atmosphere. We think that when you go into a shed the atmosphere does become humid to a certain extent by the number of people who are in it. In another case we are supposed to have a humid atmosphere in Lancashire, more humid than in some other parts of the country. We think it is proved that weaving is being carried on even with the similar yarns that we mention there without the aid of steam or humidity. For instance, take my own case: I worked in one mill in Heywood fifteen years, and there was no steaming or humidification whatever used. They are using the yarns there; we have seldom any complaints about bad work—only just now and again. That shed can carry it on without steam; in the fustian trade they carry it on without steam; and in the towel trade they carry it on without steam; then why cannot other trades carry it on?

2432. Have you ever considered it from this point of view: of course you know in the non-humid sheds there is no standard of ventilation?—I am aware of that.

2433. And every single hole and corner and crevice can be shut up, and no one can say yes or no?—Yes.

2434. In humid sheds the standard must be maintained of not more than nine parts in ten thousand of CO²?—Yes.

2435. We will suppose it is a bad weaving day, that there is an easterly wind. In the non-humid shed, with every hole and corner shut up that could be shut up you would get a certain amount of moisture from perspiration and respiration and from other sources?—Yes.

2436. Or you might even have damp clothes?—I mean to say if they closed up every aperture in a non-steaming shed naturally that shed would become a humid shed in a short time on account of the breath

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of the working people being congested in the place; that would be one reason why it would weave all right for the time being.

2437. Quite so, but would not the atmosphere of that shed be very bad?—I can only judge from results. If you took a chemical test of it you might find it was worse than the humid shed for the time being. If we have to judge from results, so far as I can see there is no more sickness produced in that shed than in the humid shed; and the workpeople will get to these non-humid sheds if they can.

2438. I gather it to be your opinion that even if the air is impure as compared with the air of the humid shed you would rather have the impurity than the moisture?—The supposed impurity. I suppose it must be more impure. The chemical tests I suppose tell us that, but the workpeople seem unconscious of it; and so far as the results of it go we do not find that the results show any sickness or deaths any more than in the case of the humid sheds.

2439. (*Professor Lorrain Smith.*) I understand you say there is no more sickness in the non-humid than in the humid shed. Is there any difference between the sheds?—I say there is as much sickness in the non-humid shed as there is in the humid shed.

2440. Is there any difference?—I can only prove it by statistics. We only know when our people are dying. We do not pay sick pay. They might be away two years and we should not know anything about it.

2441. Do you say there is no obvious startling difference between the two sheds?—I could not answer that. I can only speak in a general sense so far as one gets the impression by walking about the town and going amongst the people; there is the preference for the non-humid shed in working, and if they can get there they risk everything else, if there is any worse condition.

2442. (*Chairman.*) I gather that when a certain degree of temperature has been reached you will allow no artificial heating at all?—That is it.

2443. What degree of temperature?—Whatever the temperature.

2444. I mean at what degree of temperature would you prohibit further steam?—I should have to be a scientific man to answer it accurately, but judging as a layman I should say when it gets to 70° or 75° it is fairly comfortable, but if it is getting anything beyond that it is not a comfortable temperature to work in—over 75° we will say. I can only speak on a question like that as a layman, not as an expert.

2445. I see that you very wisely, I think, make certain suggestions on the supposition rightly or wrongly that steaming or humidity will not be totally abolished; and you say you think that the fourth schedule should be so amended as to prohibit the infusion of moisture to a greater degree than at present. That would be alternative to your first proposal?—I suggest these things as an immediate palliative. I am in favour of total extinction, though I recognise that it is not as practicable and feasible as we should like it to be.

2446. During the probationary time you would have some modification?—Yes, I would regulate it more stringently.

2447. Will you give your suggestion?—Again I should only have to speak as a layman. I take it this way: if you allow the dry bulb to reach 90° the relative percentage of humidity there is only 69 according to this table. That is 21° below the original figure. Now whether it is necessary or not to have more humidity for weaving purposes, the law does not allow it. It says you may have 69 per cent. of humidity in the air when the dry bulb reaches 90°. Now if you can exist with that you can exist with less, in my opinion at any rate, and there is far more than that allowed when the temperature only reaches 66° or 70°. I suggest that we lower the wet bulb table—I do not say to what extent, but suppose we take a few degrees as an experiment for a year or two.

2448. (*Mr. Roberts.*) Will you kindly repeat that?—I am calling attention to the amount of humidity allowed. You see when the dry bulb reaches 90°—that is an extreme point, but it might reach that in summer and it has attained it a few times in summer, the relative percentage of humidity is 69.

2449. That is a very extreme temperature?—Yes, some say it reaches more. We will take it that it might get up to 90°; if it does the law says you must have at that time no more than 69 per cent. of humidity in the atmosphere. That is 21° below the dry bulb of the thermometer. You allow up to 88 per cent. of humidity in the air when the temperature is lower—you really put more humidity in the air you tell us. If you go to a manufacturer and say to him: You must do with only 69 per cent. of humidity, whereas on another occasion we allow you 88 per cent. of humidity, then I say, I think we could put a further restriction on him and say we will only allow you to have 50 per cent. of humidity instead of 69 per cent. of humidity when the dry bulb reaches 90° and a relative proportion of humidity when the dry bulb reaches 60° or 64° or 65°. That is my idea there.

2450. You bring that down in place of 88 to 70?—I should lower the wet bulb standard I say in comparison with the dry bulb, the effect of it being that I should allow far less humidity in the air than is allowed to-day.

2451. When the atmosphere is at 70° dry bulb what would you have your wet bulb to read?—I do not know exactly what it would give in percentage. I tell the Chairman that I would allow the relative percentage of humidity only there in comparison with what I would allow at 90°.

2452. Give us what your own idea is at 70°?—I should have to work that out in proportion. I should say as 50 is to 90 what would it be at 70.

2453. Call it 20 below; take 19 off in the other case?—That would bring it down to 69. Supposing, for example, I say I would allow 69 per cent. of humidity with a temperature of 70° and 50 per cent. of humidity with a temperature at 90°.

2454. That would be wet bulb at 64°?—I had not looked that up.

2455. You are going to reduce the wet bulb temperature by 4° as compared with the dry one?—It would bring it down to 69 per cent. I think it would be best to confine myself to percentage of humidity. That is what strikes me as an experiment to see how we go on.

2456. You are getting nearly to a dry shed.

2457. (*Chairman.*) I suggest that there should be some method by which the representatives of the operatives could have an opportunity of examining the readings and records sent by each firm every month to the Home Office?—Yes, we have really nothing to guide us at present. I quite recognise that the thermometers are posted up there. There would be two in the shed, one in the centre and one at the corner, but the workpeople are not accustomed to walk from their alleys, and the people near them are not expected to copy them. We think we have a right to know what is going on and we can see whether the actual percentage is being registered or whether it is more than they are allowed to register. If it is possible to work under it we want to know where we are.

2458. I notice you say in dealing with this question it appears that the staff of Inspectors is too limited. That means that the Inspectors cannot exercise enough personal supervision?—The law says they shall inspect once in every three months. I think the Inspectors cannot do it if they try. I think it would be better in fact if they could visit every three months.

2459. You know people are crying out for Inspectors for all sorts of jobs, not only for this?—Yes.

2460. You handed in some medical statements: may I read those?—Yes, with this reservation: I wrote to these gentlemen ten or twelve years ago, and I think they were assured that these were not necessarily for publication. At the same time, we want them to say what was true, whether published or not.

2461. (*Mr. Higson.*) Are they ten or twelve years old?—1895.

2462. (*Chairman.*) One is January, 1896, another is January 6th, 1896, another is December 27th, 1895, another is November 28th, 1895. They are nearly all ten years old. Would not it be more satisfactory if you were to send in some medical opinions of a more recent date?—Yes, I simply put those in without expecting them to carry any particular weight as

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evidence on any side except that we had asked our medical advisers to give us an opinion and what they thought.

2463. All I suggest to you is that you should send to our Secretary some medical opinions of more recent date, which I think would be more convincing than these very old ones?—Yes.

2464. You know we have had longer experience now?—Yes. I did not put them in except for the purpose of letting you see that we did try to get the opinions of our medical men at the time. If they have changed their views I do not know why.

2465. (Mr. Roberts.) In your experience in Heywood have you ever known a case where operatives went up to the employers and asked for steam?—I have never known an actual case in my own experience, but I should not be surprised if I heard of one any day. I should know the reason. They have to take the choice of two evils, either suffering in wages for the time being or having some steam. If you said you can have good work without steaming, then every time their hands would go up for doing without steam.

2466. If such a case happened, would not it be likely to come to your knowledge?—Yes, if they had gone and asked for steam.

2467. When I tell you that in one of your mills steam has been asked for, and that they are now getting it, how is it that it has not come to your knowledge?—I do not know. Do you mean by that, here is a shed where they have never had steam or humidification in before, and the workpeople as a deputation have gone up and said, We should like to have steam or humidification? Or is it a shed that already exists where they have said, Turn us steam on?

2468. It is a shed which, in the history of the present firm, had not had artificial humidity until they were asked for it by the workpeople?—I should be surprised to know if that occurred in Heywood.

2469. (Mr. Roberts.) That is so.

2740. (Chairman.) I suggest that we have that in evidence.

2471. (Mr. Roberts.) The name has been sent in to our Secretary.

2472. (Chairman.) As I suggested, the members of the Committee must not make any statements.

2473. (Mr. Roberts.) I should not have mentioned the fact except that the name has been given to you.

2474. (Mr. Wilson.) Several.

(Witness.) You understand my answer? My answer is that I should be surprised to hear of a body of people who never had steam or humidification in the shed going up and asking for it.

2475. (Chairman.) I think it is perfectly lawful for any member of the Committee to ask you if you know of any such case. I think that is what Mr. Roberts asked you.

2476. (Mr. Roberts.) It is a Heywood firm. That was my question. I only thought this, Mr. Chairman; if Mr. Ogden knew of the case it would more or less corroborate the next witness.

2477. (Mr. Cross.) You took a ballot of every mill in your district some time since?—Yes.

2478. A ballot of every humid shed?—Yes.

2479. How many sheds were there where you did not take a ballot?—I should think there is another dozen in our district.

2480. Those are dry sheds?—Yes.

2481. (Mr. Higson.) You did not tell us what class of goods you were making in those sheds where humidity is used?—Whether you call them Burnley Printers or not, if I describe them you will know. Pieces about 75, 100 or 125 yards, thirty-twos twist, and about 36 weft, 60 to 70 reed, and so on.

2482. They are printers?—Yes.

2483. In the shed that you describe as being dry they are making towels, fustians and hard waste stuff?—The shed that I mean is dry and is simply making twills and plain cloths. That is a shed I worked in myself.

2484. (Mr. Cross.) Similar goods are being made in the non-humid sheds to the goods being made in the humid shed?—Yes, that is my point.

2485. (Mr. Shackleton.) That is to say, in your district the weavers have those two kinds of sheds in front of them?—Yes.

2486. Practically a similar kind of work is going on, and they feel that they can work them all on one system without steam if they can get the chance?—Yes.

2487. I understood you to say a short time ago—perhaps it was in doubt, so I will ask you the same question: do the weavers seek for the mills where there is no steaming in a case of there being vacancies?—You can only assume that by what we find: that they are scarcely ever short of weavers at the non-steaming places, and we know they prefer to get to them if they can. That is all that we find, and we find them constantly complaining about steam wherever it is used.

2488. (Mr. Higson.) Will they leave a steaming shed and go to a dry shed?—They will so far as my knowledge goes if they get a chance.

2489. (Mr. Cross.) What difference in earnings is there between a dry shed and a wet shed if they are making similar goods?—Take the case of a dry shed: it is about 28 twist and 36 and 40 weft, 66 reeds twills.

2490. (Mr. Higson.) That is a very different thing to 56 or 58 reed Burnley Printing?—Yes.

2491. (Mr. Shackleton.) What do they earn in the two sheds; is there any difference supposing you have the same sorts working in both places?—Some humid sheds are badly conducted, but in what I should call a well-conducted humid shed and in a non-humid shed I think there is very little difference in the earnings in the two sheds; but in a shed that gets upset with the sizing where they are supposed to have steam the wages come down terribly, and there is great uproar when the thing gets out of order and matters are not going properly.

2492. (Mr. Higson.) That is a mistake which affects wages everywhere. But you do not suggest that it weaves as well in the dry sheds as it does in the humid sheds?—Yes, it does.

2493. It does?—Yes, we have far less complaints of bad material and bad work in the non-humid than we have in humid sheds. All our complaints come from the humid sheds. The slightest change in atmospheric conditions seems to touch the humid sheds and they are constantly manipulating the steam, and then trouble arises. But there is not the same susceptibility to atmospheric changes in the non-humid sheds.

2494. (Mr. Shackleton.) Have you any sheds in Heywood that have a mixture of cloth, some say with 15 per cent. size running up to 60 per cent. of size in the same shed?—I do not think so. I can only say this: that a manager of one of the largest sheds told me last week that sometimes the average of his shed was about 25 or 30 per cent. of size; but he had had cloths in with 130 per cent. of size on. It is not a heavy sizing shed. It is an exceptional thing with us to find a mill with 25 per cent. of size and 130 per cent. of size going on in the same place. If I might just particularise we seldom get any complaints from year's end to year's end from fustian weaving sheds or of bad work.

2495. (Mr. Higson.) You have a two-fold warp; you have everything like we have?—It only shows what can be done. They could not force you to put bad material in. Now I can make a plain statement to you about deaths. As I told the Committee, we have no statistics of sickness; but on an average membership of 2,300 for the past five years we have paid for 80 deaths, which averages about 16 per year, and the average death age is about 40.

2496. (Mr. Higson.) What is the death rate of Heywood?

2497. (Mr. Shackleton.) At the same age?

(Witness.) I do not know. I only make that statement. The causes of death are various, that is chronic rheumatism, consumption and so on. But I do not want to say that any of those deaths are the direct result of steaming.

2498. (Mr. Cross.) You do not say whether they are dry shed or humid shed victims?—I can trace them to dry sheds and humid sheds. I can only say it is not

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significant enough to show that the humid sheds have killed them. I only state the facts as I find them.

2499. (*Chairman.*) About dust: do you find that the humidity keeps down the dust to some extent?—I can only say I seldom hear much complaint about dust in our district. We find dust more where you have very heavy sizing, and we have not very heavy sizing.

2500. (*Chairman.*) I have suggested to this gentleman with regard to these medical opinions that if we could get any more recent ones we should be glad. You see they are ten years old.

(*Witness.*) The conditions are just the same now as they were twelve years ago so far as I know. But that does not signify.

The witness withdrew.

SIXTH DAY.

Friday, February 7th, 1908.

At Manchester.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
Mr. H. HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor J. LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

Mr. HARTLEY EMMOTT, called in and examined.

2501. (*Chairman.*) Will you give us the name of your mill?—The Stanley Mill, Burnley.

2502. You are the owner of the mill?—One of them; I am the principal.

2503. What class of goods do you manufacture?—Burnley Printers.

2504. That means, I think, light sizing?—We just size them to weave: perhaps 10 or 20 per cent.

2505. You know, of course, that there has been a great deal of discussion as to the desirability of introducing artificial humidity into weaving sheds?—I am sorry to say I do.

2506. You know a good deal about it?—Yes.

2507. As a manufacturer, are you of opinion that the introduction of artificial humidity is necessary for efficient and economical weaving?—Yes.

2508. And talking firstly from a weaving point of view or a manufacturing point of view, what would be the effect on the trade were any regulation made saying that no artificial humidity was to be introduced?—It would certainly be detrimental to the trade. If you want me to give my experience, I could do so.

2509. Yes, I may perhaps ask you that afterwards. You think it would be seriously detrimental?—I do.

2510. You know, of course, that weaving is carried on in a very large number of districts?—Yes.

2511. Without any artificial humidity?—Yes.

2512. And many witnesses have told us that it is done in a perfectly satisfactory manner: I mean by satisfactory that the weaving is good, and that it is done in an economical manner?—It is not as good without steam as it is with steam.

2513. How would you account for the fact that in some places steam is used and in others it is not used?—We are not using it in Burnley in some places at the present time on account of the agitation, I should say, by the Weavers' Association and the prejudice they have created by their agitation.

2514. Do you think that artificial humidity is necessary in every branch of the trade for efficient and economical working?—I can only speak for my own, and I think it is necessary in our trade.

2515. You know there are different methods of humidifying?—Yes.

2516. Which do you think the best for efficiency and comfort?—We have only had Hart's machines in.

We have ten of Hart's largest machines in our place. Of course, they are not working at the present time, I may say, and I think they are a very satisfactory machine. One fault with them is that the weavers can see the steam from those machines, and, of course, that does not suit the eye. If they could have been so framed that the weavers could not have seen the steam I do not think there would be much difficulty with Hart's machines. I think from a ventilating standpoint they are perfect—that is my opinion.

2517. What readings of the wet and dry bulbs do you consider to be the best for weaving purposes?—If you are going to take 70° and below I think to keep within three or four we should not have any trouble even with the weavers so far as the steam is concerned between the wet and the dry bulbs.

2518. Let me understand. You say if you are going to take 70°?—Up to 70°.

2519. I am not suggesting anything: I would rather have your opinion.—Taking up to 70°, from 3 to 4 I think is a very nice difference, and we should have no difficulty as far as the steam is concerned.

2520. Up to 70° a difference between the wet and the dry bulbs of from 3° to 4°?—Yes.

2521. With that difference could you weave efficiently?—Yes. Of course, if you will allow me to say it here, I would say that our difficulty has not been exactly with the steaming; it has been with the quantity of air we have had to bring in. When these ten machines are in order they will bring in 250,000 feet each per hour. That will change the air in the place something like once every 25 minutes. That is too much. The weavers complain about the draughts, and that is our difficulty generally. They are very susceptible; they work in such a condition with their coats and waistcoats off and so on, that they feel the least bit of draught.

2522. Do you mean by that that it is necessary that you should introduce this amount of air to maintain the legal standard of ventilation?—That is what we have got in to do that.

2523. But is it necessary to do that?—To be right on all occasions I am afraid it is necessary to bring in somewhere near what we are doing. I think to bring in half of it would be better for the work and for the weavers and all concerned.

2524. Do you mean that you would like to see the standard of purity as measured by the CO₂ raised a little bit?—Yes, I think it would be better for all concerned.

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2525. You think there would be less draught for the workers?—Yes, I do.

2526. And greater comfort for the workers?—Yes, I do.

2527. You said something about 70°: you were going to say I think something about above 70°?—I was taking it at 70° and below. I have not taken the same interest with regard to over 70° as I have under.

2528. Is there any point at which you would cease to introduce artificial humidity at all?—I could scarcely answer that. You see I am not a scientific man, but what we go by is the readings of the wet and dry bulbs, and what we have found to act fairly well under all conditions. Of course if the weather is damp outside we certainly do not require as much steam, and we regulate according to the wet and the dry bulbs.

2529. Your experience shows that a temperature of about 70° and a difference of I think you said 3° or 4° gives you sufficiently good results?—Yes.

2530. You said just now that you would like to give your own experience; I think the Committee would be very pleased to hear that.—As I said before, we have ten of these machines in. We started in November, 1901, with them, and we ran them till February, 1906; that is a little over four years. Now during that time we got a much better average than we did before. We got better cloth; I mean the cloth was freer from faults: we had less trouble with it in Manchester. We got the lengths better and more regular, and we had not that difficulty with east winds and frosts that we have had. I may tell you that ours is a large place, fairly lofty, and built so that it catches the east wind pretty freely. We had not much difficulty there; we could regulate it so that that did not affect us. We found too another thing. Of course we have young persons. They start off as tenters; they get on to two looms, then on to three, then on to four. We had much less difficulty with those young people when we had steam than we have without it, and they could do the work much better, and it was much better for them, because you see children are sooner fast than upgrown persons; the work went so much better that they could run the looms without much difficulty. During that four years I got a very good name for my cloth; I am sorry to say that I am not maintaining that now that we have stopped the machines.

2531. Why did you stop the machines?—That is a question I thought you might ask me. Of course you are aware that during the last three and a half years we have had a lot of extensions going on in Burnley, and those extensions have been just in the immediate neighbourhood of our mill, within a very short radius. Something like 11,000 looms have started within the last three and a half years. Now owing to the agitation, as I should call it, of the Weavers' Association and the prejudice created by that agitation the weavers were leaving us to go to the new places that were starting up, and we stopped those machines to keep the weavers—that is why we stopped them.

2532. You stopped the humidifiers, you mean?—Yes.

2533. From a manufacturer's point of view what has been the result since you stopped?—The result has been that we have put seven and a half per cent. on the wages, on the list, and the average has not gone up any.

2534. You put seven and a half per cent. on the wages?—Yes, and the weavers are not earning any more money than they did before.

2535. Although you have put on seven and a half per cent?—Yes.

2536. According to that you estimate that the difference between when you had steam and when you had not is seven and a half per cent?—Yes.

2537. On total production?—Yes.

2538. Was this seven and a half per cent. universal?—It was universal. I think it went on 5 per cent. at first and then two and a half after.

2539. Then as a matter of fact the weavers are getting approximately the same wages that they had before?—Yes.

2540. And supposing that they asked you to put the steam on again or that you decided or mutually agreed

to put the steam on again, do you think that their wages would increase?—I think they would increase 6d. per loom.

2541. Per day?—Per week.

2542. Per loom per week?—Yes.

2543. A good many witnesses have told us that humidification is rendered necessary by the fact that inferior yarns can be used where there is humidity. Can you tell us anything upon that point?—Well, I did not use inferior yarns when I was running my machines, but I got a much better production off the same yarn.

2544. Have you used the same class of yarn right through?—Yes, practically the same marks.

2545. Have you had any experience in other countries besides this?—No.

2546. And probably your experience is limited to your own work?—Yes.

2547. (Mr. Cross.) You remarked that you thought that the present standard of 9 volumes of CO₂ in 10,000 should be increased. I should like to know how much you would increase the present standard of purity. You said you thought it should be increased and it would be to the benefit of everybody concerned, of benefit to the weaving and to the workpeople too. Can you say how much?—I think I said at the beginning that I thought if we brought about half the quantity of air in it would be better for all concerned.

2548. Does that mean 18 volumes in 10,000?—No, I do not suppose it would make any difference. Of course, I do not think as a cotton manufacturer I can go into the question of how many volumes of CO₂, because it is a thing I have not gone into; but I can say something as to what quantity of air, because I have tried it in all ways.

2549. There has been a loss of seven and a half per cent. in wages?—Fully.

2550. That is since you stopped the humidifiers in 1906 to the present time?—Yes.

2551. Has there been no other cause beyond that—to be more clear, I mean has the character and quality of the yarn had anything to do with it?—We have kept the quality of yarn up as high or higher than it was when we were steaming, and as it was before we began to steam.

2552. (Mr. Shackleton.) Were you able to get hold of the good quality last year?—We got as good as we could.

2553. Exactly; the quality was reckoned to be a bit down last year, was not it?—It was, I daresay, but the quality at the present time is fairly good, and in some cases by going on to fresh marks we kept the quality of the yarn fully up to the standard of what it has been in past years.

2554. With regard to what you said about the Weavers' Association, you stated that they had agitated this question, and that was the cause of the weavers not liking steam?—I think so.

2555. You do not think the weavers themselves object to it, but that they were not allowed to please themselves?—No, I do not think so as to the most of them.

2556. Your impression is that this agitation against steam originates from the officials and not from the workpeople?—It is very largely.

2557. That is your impression?—It is.

2558. I notice that in your particular mill there was a ballot of the weavers?—Yes.

2559. Probably not one fiftieth of the weavers were ever seen by the officials at all or ever had a chat with them about it?—I have a different opinion to that, Mr. Shackleton. Here is a man comes, an official of the Weavers' Union—

(Mr. Higson.) Is it necessary to record this?

2560. (Mr. Shackleton.) A statement is made that this is an organised effort on the part of the officials against steaming, and that it is not a voluntary opposition on the part of the workpeople. That is the only point I want to get at. I want to know what grounds you have for saying that?—Here is a man comes, an official of the Weavers' Association, and stands at the door; he gives out the voting cards as

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the weavers are coming out. Everyone that comes out, it does not matter whether he is a weaver or what he is, gets a card of this kind. Of course we look upon it that it goes round the place to these people "Vote against it."

2561. And your impression is that that is the first move in this question of steaming?—I do not know about the first move: I do not want to go too far into that.

2562. Do you know whether your weavers had ever complained to the officials before any ballot was taken?—I do not know.

2563. You are not aware?—I believe that the complaints generally, if there were any, were not exactly about the steam, but about the draught.

2564. But it was against the introduction of this humidity in the form in which you had it in your mill, was not it: I am rather interested to know?—I do not know that.

2565. I want to know what grounds either you or any other employer has for saying that this is not a genuine agitation?—I do not say it is not a genuine agitation.

2566. Then if it is genuine it comes from the people?—I do not think that the ballot was taken in such a style as to leave it fairly as open as you imagine.

2567. Was there a time since you took out the humidity where it was turned on by your Manager without your knowledge on a very frosty morning or on a morning when there was an east wind, and the weavers objected to it, even under the worst conditions?—The steam was not exactly turned on; there was just a little bit; the valve was just tampered with a little. There were no fans on. That occurred at a time when we had on a strike of the tacklers. The tacklers left the place the day after Christmas, and this accident happened on the Friday morning. Of course we had had an agitation in the shed all the day on account of those tacklers, and they had left a lot of relations in the place who were determined that we should have those tacklers back; and of course on the Friday breakfast time they stopped out; but I really do not think it was on account of any steam that was turned into the place, because there was not as much steam turned into the place as would come out of a half-inch pipe in two minutes; still it was going on—the agitation had been going on before that.

2568. You stated that in your opinion it was not the operatives' objection at all, that it was the officials' objection?—I think it led from the officials very largely.

2569. (*Professor Lorrain Smith.*) How do you ventilate now, or do you ventilate since you gave up using Hart's apparatus?—We have tried to ventilate. In the hottest days in summer since we gave that up we have tried bringing air in; but the moment we turn on the fans the weavers come up in the office and ask us to stop them.

2570. That is on account of the draught?—Yes, it is both for draught and because the warps begin to weave worse straight off. But they would rather have the heat than any ventilation: that is my experience. Now if we only have a small piece of glass out in one of the windows at the top of the shed, the weavers about that place will come and ask us to get that put in, there is a draught.

2571. What do you think is the reason for them asking for this heat or preferring the heat?—The conditions under which they work. They have got into the habit of working stripped almost in the places generally, and they are susceptible to the least bit of draught; that is what we find generally; they would rather have the heat and the bad air than ventilation in the place.

2572. Then you think it does not bear on the weaving at all: the heat does not help the weaving?—The heat, if the wind is in certain quarters, does not worsen the weaving very much. On the question whether it will worsen it at all or not, of course, if you have an east wind that will worsen it considerably; but if you bring air into the place you begin to worsen the weaving straight off.

2573. (*Mr. Cross.*) It is not a matter of a broken window; is not it that there are two serious things

attached to it, there is a draught for one thing which the weaver can feel, and there is also a draught which affects the weaving?—The same thing obtains if you have ventilators on your shed and you open them.

2574. With regard to a broken window, you say they like to let you know they want it put in immediately?—Because it is draughty.

2575. It would have a physical effect on them without doubt irrespective of the heat or the class of work?—They feel the draught independent of the class of work.

2576. (*Chairman.*) I think most people who have studied ventilation will draw a very distinct line between ventilation and draught. Very few constitutions can stand draughts in hot rooms; but the admission of air properly tempered to suit the time of year is quite a different thing from broken windows or open windows.

2577. (*Professor Lorrain Smith.*) I want to ask you about the temperature you mentioned of up to 70°. You say that temperatures up to 70° are ideal temperatures for weaving?—Yes, I should say from 65° to 70°.

2578. Can you maintain that, say, with Hart's humidifiers, or how do you get on in the hot weather?—We go above that. We cannot exactly regulate the heat in the place, that is, not when it gets above that. Of course, if it is cold, we can warm the air.

2579. An ideal situation would be created if you could keep the shed at all times at this temperature?—Yes.

2580. The chief difficulty is in the summer, I gather, when the temperature is high outside?—Yes.

2581. Can you throw any light on how one might meet that difficulty?—I cannot.

2582. You have never made any observations on that as to drawing the air, say, through moist screens, jute screens?—No, we have not done anything in that line.

2583. (*Chairman.*) If I am not interrupting I should like to call your attention to the fact that part of Hart's system is to have a sort of matting on the top which is kept damp, and the intention of that is to cool the air in the summer time?—We have not done anything in that respect.

2584. (*Professor Lorrain Smith.*) Do you know any place where that has been used?—I do not: not of my own knowledge.

2585. One would be interested to know whether that makes the draught worse in hot summer days?—I have not heard of one at all in Burnley, and, of course, what they are doing outside I do not know much about.

2586. (*Mr. Shackleton.*) Can you give your reason why you did not try that system?—No, I do not know that we ever bothered about it.

2587. Of course, when you got the machine you knew that that system could be used, did not you; that is, it is part of the specification, and all the details connected with it are given, and it is part of the machine really?—No, I do not think it is part of the machine; and I do not think it was introduced as part of the machine when we ordered them.

2588. (*Professor Lorrain Smith.*) With regard to the higher temperatures, when do you reach a point at which it becomes difficult to work, and there is real complaint on the part of the operatives of the conditions of working?—I do not think we have ever much complaint until it gets up to 85° or over.

2589. That is 85° dry bulb?—Yes.

2590. Is that in a humid shed or in a dry shed?—Either. We have never had much complaint when we have kept down to 80° or thereabouts.

2591. That would be 80° dry bulb and 75° or 76° wet bulb?—I am referring to the dry bulb.

2592. You gave 3° or 4° of difference?—Yes, of course since we gave up steaming we have been higher than ever we were when we were steaming.

2593. You might tell us what temperatures you have gone on?—We took the records for 12 months after we gave up; on August 31, 1906, we got to 90° in the afternoon.

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2594. Did you by any chance take the wet bulb too?
—I have not brought it.

2595. You have got it?—Yes.

2596. It would be rather interesting to have that. Will you let us have those records for the 12 months with the wet and dry bulb figures after you gave up steaming?—We sent them all to the Home Office. We happened to send one month's records up to Mr. Williams at the Home Office, and then he asked for the lot, and then we sent the lot; but I should be glad to let you have them.

2597. (*Mr. Wilson.*) Is that for 1906?—This was on August 31, 1906; the temperature in the afternoon was 90°, and in the morning, that will be between 10.30 and 11.30, it was 88°.

2598. (*Professor Lorrain Smith.*) How did the work go on as far as the comfort of the operatives is concerned?—I may say they are not very comfortable when it gets so hot. One of the main reasons why we ordered the machines at the beginning was this. One day in July (I think it was the day but one before Burnley Fair, and that generally started, before the last year, on the Thursday following the 8th July) the weavers came up and said it was so hot that day they wanted us to stop for the next day. Of course, we had been considering the matter before; but that made us make up our minds to order humidifying, and see if we could not alter this state of things. Of course, being very hot in a weaving shed, there is a bad smell too.

2599. What did you hope to get by the humidifiers on those hot days?—We hoped to get it much sweeter and pleasanter in the place by having fresh air in.

2600. You were not ventilating?—No.

2601. (*Mr. Shackleton.*) You had the ordinary ventilation going on in July of that year?—We just had the ventilators round the walls open.

2602. But no mechanical ventilation?—On the tiles we have just an opening and holes underneath.

2603. (*Professor Lorrain Smith.*) You meant you would get a mechanical system of ventilation?—Yes.

2604. (*Chairman.*) Is that in the bays?—They are in the bays on the top. There is a tile here that has an opening in it, and underneath we have a few holes in the woodwork.

2605. Is there an opening at the foot of the slates?—No; there is no opening at the foot of the slates, but at the bottom of the window—say, a quarter of an inch between the woodwork and the window.

2606. Is that all across, or just at certain places?—Practically all our windows are that way. There are four spaces between.

2607. (*Mr. Roberts.*) When you stopped this humidification, did you find any difference in the dust in your shed?—Yes, there is much more dust stirring about.

2608. Have you in that dust fibres of cotton?—Yes.

2609. How much more dust would you imagine there is?—I could not give you a percentage, but our place from the warehouse wall to the back side is 273 feet, and when we were steaming the atmosphere was so clear that on the wall 273 feet away, looking from the window of the warehouse, we could see what there was there on the wall. If there was a shuttle or a leather, we could tell what it was. We cannot do that as plainly now as we could before. The atmosphere was certainly clearer when we were steaming.

2610. It has been alleged by one or two of the witnesses that, whilst it is possible that doing away with artificial humidity may make the weaving worse, still, the weaving could be improved again by buying a better yarn, a better twist; and it was also stated that if a manufacturer would pay a penny per pound more for his twist, then any place could do without humidity. I should like to ask you what, in your opinion, one penny per pound of twist would mean to you per annum?—It would mean £280 per week.

2611. That would be £14,000 a year?—Yes.

2612. (*Mr. Shackleton.*) Could we have the number of looms in this place?—1,830.

2613. (*Mr. Roberts.*) If you were compelled by the total abolition of humidification to buy this better

yarn, and thereby incur an extra expense of £14,000 a year, how much of that could you hope to regain by selling your cloth on the Manchester market?—I do not think we could regain much of it at all.

2614. Would your cloth be any better thought of in Manchester under those circumstances than it is to-day under humidified conditions?—None whatever.

2615. Therefore, although it cost so much more to manufacture and produce and put on the market, still you could not hope to get more than, say, 10 per cent. of that?—No.

2616. (*Mr. Higson.*) I should like to ask you this: you say that in February, 1901, you put in this humidification?—In November.

2617. And you ran it on till February, 1906, at which time you stopped it?—Yes.

2618. Had you any complaints from the weavers direct to you or to your manager about the humidity previous to your stopping it?—The complaints generally were about the draughts.

2619. You had complaints?—About draughts. One of the complaints was generally in the morning. When you are warming up in winter with Hart's humidifiers there is a trap for the coils. Then there is a pipe for the outlet on to the shed roof into the troughing. This was in the habit of getting frozen up; and moderately often we had difficulties with these traps and the water not getting away as it should do, and then the coils get cold and do not warm the air. What we have done since is this: we have drained them all off so that the water runs off of itself, and has not to run up. We have not had much difficulty since then.

2620. You have not had them running since February, 1906?—No, but we did that before we stopped them.

2621. If that was the chief complaint, did not it strike you and the workers too that they might be run when the outlet pipes would not freeze, or when you had a chance of warming the air; did they object to the humidifiers running under any conditions?—They did not put it to us in that way. The strong objections came to us publicly. What I say is, that the quantity of air we have to bring in is too much; it creates draughts in the place that you cannot get rid of.

2622. The distribution of air is the question and the difficulty that we have. 250,000 feet is what you suggested?—Two and a quarter million feet per hour.

2623. You said the weavers were leaving you and going to new sheds?—Yes.

2624. Did they tell you why they were going?—If they did not tell us direct, we got to know that it was on account of the steaming.

2625. Had any of these new sheds any form of humidity at all?—No, none whatever.

2626. You say that the production does not run up corresponding to the increase of wages?—That is so.

2627. You still at the same time say that your warp has been as good as it was previously?—Yes.

2628. Everybody who understands weaving knows that wherever you have a warp dried you do not get as good a cover on your cloth as at the beginning?—That is so.

2629. Have you had to give any extra length of warp to meet this?—Yes.

2630. In other words, your production has gone down and your cost, in consequence of having to give a longer warp, has gone up?—Yes, and we have had more difficulty with the cloth.

2631. (*Mr. Cross.*) With regard to the question put by Mr. Roberts as to the increase of one penny per pound in the price of yarn representing £14,000 a year, has not that increase actually taken place in the last few years?—Not on the same lines.

2632. Taking the yarn that you now use and that which you used four years ago, is it a penny a pound more now than it was?—Yes.

2633. You have had an increase of £14,000 on the cost of making cloth; still you get the price on the market for it?—I did not take it that that was the way he put the question.

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2634. Still it is exactly the position?—No, I take the question to have been put in this way: Supposing we are giving 10d. a pound for our twist, and with the humidifying that will make the cloth satisfactorily, and then supposing we stop humidifying and give 11d. per pound, and that will only make it satisfactorily, how are we going to gain anything by giving the extra penny?

2635. (*Chairman.*) First of all do you admit that it would make it satisfactorily without humidity if you gave an extra penny? If you do not, we will assume it for the sake of illustration?—Of course you might get yarn that you could work if you are prepared to pay for it.

2636. That you could work without humidity?—Without humidity.

2637. Is your estimate that it would be a penny a pound more?—I do not estimate what it would be; I am not giving any estimate.

2638. (*Mr. Roberts.*) I put the estimate because it was stated in evidence before that by paying a penny per pound more they could achieve that result.

2639. (*Chairman.*) That is how we get the extra penny?—You would achieve it at the cost of an extra penny.

2640. In your particular work that would mean what?—At one penny per pound something like £280 a week.

2641. (*Mr. Cross.*) Any increase of cost owing to humidification ceasing to be a factor, the effect on the market would be alike: there would have to be an increase in the price of the cloth?—If we are going to run on long you may take it that we will have a price that will pay. We only go on temporarily losing money.

2642. I want to know what the effect of the penny per pound up would be everybody being on the same level?

(*Mr. Roberts.*) I think, Mr. Chairman, this is not a fair question, because if the question Mr. Cross puts has to be answered any witness must consider the point of the whole world.

(*Chairman.*) But it is quite open to anyone here to follow up the question Mr. Cross puts.

(*Mr. Cross.*) £14,000 is a great thing. I wanted it further explained.

(*Chairman.*) I had it in my mind afterwards to ask whether foreign competition would not step in. That question can be followed up when Mr. Cross has put his question.

2643. (*Mr. Cross.*) That is a matter for the witness to answer, whether the whole of the market here being raised to the extent of £14,000, it would not have to rise to the occasion as it has had to do by the difference in the price of yarn paid four years ago, and the price paid now.

(*Witness.*) If we grant that we have foreign competition to deal with, I think we are all aware that the foreigner can use his humidifiers, and he does it to a very great extent. Now, if we through not using humidifiers have to pay one penny per pound extra for our yarn, we are going to be at a great disadvantage, because we are going to add to the price of our cloth considerably.

2644. (*Mr. Shackleton.*) I take it you mean this: that your competition with your foreign competitor would be keener?—Yes.

2645. But the competition among yourselves would be exactly the same?—If we are all put on the same footing, of course the competition will be the same.

2646. There are quite a number of mills working the same cloth as yourself that use steam?—Yes.

2647. They are having an advantage over you, and you contend, I take it, that those who are using steam do have an advantage over you?—Yes.

2648. I want now to get back to that point. The statement is made by the inventor of these machines that you can save about 33 per cent. by increased production, lessened cost of yarn, economy of sizing?

(*Mr. Roberts.*) Thirty-three per cent. of what?

(*Mr. Shackleton.*) In cost of yarn and other things, improved production, and everything brought in.

(*Witness.*) No, they never put that before us.

(*Mr. Roberts.*) They do not say that.

2649. (*Mr. Shackleton.*) They tell you there is increased production?—Yes.

2650. That you can use a worse class of yarn and get that increased production, and it is really this that causes the employers to desire to have humidity?—The same class of yarn with humidity will weave better and make better cloth.

2651. In other words, a lower class of yarn, with humidity, will do as well as a better class?—We did not try it.

2652. That is so, is not it?—We make a certain class of cloth, and we have to use a certain class of yarn for that. That class of yarn will make the cloth better with humidity than without it.

2653. If they are making a Cheshire printer, or something on the same line, without steam, they have to pay a better price for the yarn than you have to get the same result: putting it that way, is that correct?—I do not think that necessarily follows.

2654. To get as good a result, they have to pay more for it?—Well, they could get a better result with the yarn than they do if they were steaming.

2655. In other words, have they to put better stuff in to make the same cloth as you?—I do not think they would put better in; but they would make the cloth more satisfactorily.

2656. You would not admit that, in order to get as good results as you, they would have to put better stuff in?—I admit they cannot make the cloth as good.

2657. They make a satisfactory cloth, do not they?—They do for the class of cloth.

2658. (*Chairman.*) There is one point I think has not been touched upon that perhaps the witness can give us some information upon. It has been suggested from time to time that by a different method of sizing the necessity for artificial humidity might be done away with. Some witnesses have told us that for a limited time they were content to get inferior results, knowing that in a short time, by a different method of sizing, the results would be the same: can you tell us anything on that point?—I do not know that I can; only we do not use any chemicals at our place.

2659. Do you know of any method of sizing which would improve your weaving, assuming that you did away with humidity, as you have done—have you altered your method of sizing since you did away with it?—The only thing we have altered is this: we are bound to run them a little damper, and on that account we are more subject to mildew, and we are subject to this, if we do not mind, in running them damp, the warp will fall away from the side of the flanges, and then that naturally makes them that they have to run with part of the side out, and that spoils the cloth to some extent.

2660. Have you had experience of mildew in the beam?—Yes, many a time.

The witness withdrew.

Mr. ROBERT TEMPLE, called in and examined.

2661. (*Chairman.*) You are a cotton manufacturer?—Yes, and spinner also.

2662. Will you give us the name of your works, please?—Rose Grove Mill.

2663. Situated where?—Burnley

2664. How many looms have you?—550.

2665. Is your weaving shed carried on upon the principle of introducing artificial humidity?—Not now; we have stopped it. It is a dry shed.

2666. You have stopped it altogether?—Yes.

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2667. How long have you stopped it?—Two years.

2668. As a manufacturer, are you of opinion that the introduction of artificial humidity is desirable for efficient and economical weaving?—Yes; most decidedly.

2669. You are decidedly of that opinion?—Yes.

2670. For all classes of weaving?—Yes; I should say for all classes.

2671. You know, of course, that a great deal of weaving is done in dry sheds?—Yes.

2672. As a matter of fact, at present you are doing it yourself?—Yes, we are doing it ourselves.

2673. In many parts of the country, we understand, there never has been any humidity?—No.

2674. Will you tell us, please, your reasons for giving up artificial humidity?—The weavers objected to it, and there was a strong public opinion, both in the town and amongst the weavers themselves. The weavers objected; our best weavers were leaving us, and going to places adjoining, where they would receive even less money; but they objected to steaming on the principle of injury to health; medical men also were opposed to it.

2675. When you introduced humidity, by what system did you do it?—The name was Hart's Humidifier.

2676. And did the weavers themselves ever make any representations, or complain to you?—Not on account of health, no.

2677. Or discomfort?—Nor discomfort.

2678. Then how did it come to your knowledge that there was this feeling?—Well, you see the best weavers were leaving us; we began to find out that the best weavers were leaving us, and we either had to take on inferior hands or let the looms stand.

2679. When they left you did they give you any reason for leaving?—Yes, humidity was the reason.

2680. When the individual worker sent in his or her notice probably you would ask why they were leaving?—Yes.

2681. What was the reason given?—The steam, the humidity; they were going to work in dry sheds.

2682. Then you gave up humidity?—Yes, we have given it up for two years.

2683. What has been the effect upon your production?—In money, it is 6d. a loom less.

2684. The weavers get 6d. a loom less?—Yes, they have to work harder, and the cloth is inferior.

2685. You think the cloth is inferior?—It is, decidedly. I was speaking to the weavers, and they estimate—it is the warp that is mostly affected by the steaming, the weft is not affected—they estimate that where five ends break in a dry shed only two would break in a humid shed when there is humidifying; the weavers themselves estimate that.

2686. And you say that an inferior cloth is produced?—Yes, decidedly.

2687. Has that affected your market in any way?—Of course it has; we have more allowances to make for inferior cloth, and of some cloths we have had to give up the manufacture, they were too difficult.

2688. Do you say that your profits have been to a minor or a serious extent affected by this change?—Yes, we do; it must have had a detrimental effect; we are getting a smaller production and inferior cloth.

2689. Since you changed your system of working, that is from the humid to the non-humid method, have you altered your sizing in any way?—Not at all.

2690. Of course I am asking you—you know much better than I do—it has been suggested that by a different method of sizing enough moisture could be put into the warp to prevent that breaking we have heard of?—We have both light and heavy size. The light size is pure, but in the heavy size we have always used chemicals.

2691. I understand you have not altered your method of sizing?—No, in the light sized goods we are sizing just the same, and in the heavy size also.

2692. Do you know of any method of sizing which would do away to some extent with the necessity for artificial moisture?—No, not possibly.

2693. Are you using the same class of yarn, the same twist as before?—Yes.

2694. Right through?—Yes, we spin ourselves, and for the forties twist it is rather a difficult weave; we have a specially prepared yarn, a double roving yarn, the best we can make.

2695. Were you able to use, or did you when you were using artificial moisture, use a yarn inferior to what you are using now?—No, I do not think so; we have tried to keep it just the same; I do not think there is much difference.

2696. What do you consider a good temperature for weaving?—68° in the dry, and 64° in the wet. We never needed to get within the Act or near the Act; four degrees was sufficient. If we could have always kept to that that would have been quite satisfactory.

2697. I think you said you had both heavy and light size?—Both heavy and light.

2698. Is heavy and light sizing done in the same room?—Do you mean woven in the same room?—

2699. Yes?—Yes.

2700. Does this statement apply both to the heavy size and the light size?—Yes, they are equally affected.

2701. (*Chairman.*) Here we get a case of heavy size and light size both in the same room?—Yes.

2702. (*Mr. Shackleton.*) What do you mean by "heavy"?—We make a dhooty on which we put about 75 per cent.; then we make a cambric which has nearly 4,000 ends in the warp of forties twist; we want 15 per cent. on that to weave, but we size with flour.

2703. (*Mr. Roberts.*) No china clay?—No china clay in the light goods, the cambrics.

2704. But in heavy goods?—Yes, in the heavy goods we have. It is rather a difficult weave. The number of ends make it difficult. Although we are in Burnley we have more the Blackburn style of goods.

2705. (*Chairman.*) Have you zinc in any form?—Yes, a little zinc for antiseptic purposes, and also chloride of magnesium in the heavy only.

2706. Have you had any complaints about draughts?—Yes, after we gave up we were a very good shed as far as the atmosphere went; we were under the 7 minimum of CO₂. I should not like to say how much it went up after we stopped steaming. Mr. Rogers, who was the factory inspector then was continually saying then, could not we ventilate in some way. We had ventilators in the bays from the end of the shed, but the weavers would not have them open. If we opened them they shut them. So then we tried running the fans much slower, and so on, and warming the air, running two machines; but we found it impossible to weave, and what we have come to is this: that undoubtedly if you draw air into the shed or out of it, you must have humidity: you cannot ventilate by mechanical means unless you have humidity—at least we could not weave.

2707. Under all meteorological conditions?—Under all. There might be two or three days in the year, perhaps, when the atmosphere is very much laden with humidity, peculiar days when it is all moisture; we might then, but even then it creates a draught by blowing air in, which the weavers complain of.

2708. Do you think that they would complain if the draught were warm air?—We have tried it with warm air using the apparatus without steam, but warm air as it came in seemed to create a draught, and they complained of it.

2709. (*Mr. Shackleton.*) Have you ever worked under one of these machines yourself—did you ever work inside a weaving shed?—Yes, I learned to weave. We had them from end to end of the bays; the current would traverse across the bays; we have also skylights.

2710. You could always feel them when you were a weaver?—Yes, a weaver will not work under them. It is all right for those far away.

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2711. I want just to ascertain from you, Mr. Temple, the origin so far as you can remember, of the refusal of the weavers to work under this steam any longer. You say it really started—you first became aware of it, rather—through the weavers leaving?—Yes.

2712. Do you think that it was so far as they were concerned their own idea of the thing?—It was a popular impression; that is all I could say. I could not say that each individual weaver had that idea. Nobody ever complained to us of ill health on that score.

2713. Even without any complaint of ill health, and knowing that they were losing 6d. a loom, in the case of six-loom weavers 3s. a week, they would prefer to do without it?—Yes; I do not know whether they would now; but that was the opinion in those days.

2714. They are working in a dry shed now where the same thing would happen?—Yes, but not so comfortable—I mean in this way, that they want the same money, and they cannot get it.

2715. You have given some figures which are rather interesting; probably you have given very great care to them, in which you say there are five breakages to-day against two—in a similar length of cloth you mean?—Yes, in a piece.

2716. That is to say, it is once and a half more?—Yes, quite that.

2717. That is rather a big proportion?—I took pains. I wanted some figures. In a shed you have always a weaver you can appeal to, a steady sort of man that has worked a long time in that place, and ask his opinion.

2718. Supposing you were to tell your weavers that from your own observations and inquiries from your staff the wages had gone down 2s. for a four-loom weaver, 3s. for a six-loom weaver, and that the breakages were more than as many again than they were before, what do you think the effect would be upon them—do you think they would ask for steam under those conditions?—No, they will not.

2719. Another point you have made, I think, is well worth noting: you said that if you got to 68° of heat and 64° wet, you think it would be satisfactory, even with 75 per cent. of size?—Yes, we do not want any more.

2720. (Professor Lorrain Smith.) Did you use the Hart humidifier with the arrangement they have for cooling the air?—No, we never did that; we have not had that put.

2721. Could you tell us anything about cooling the air with artificial ventilation?—No, we have not required that.

2722. Hart's has that arrangement?—Yes, but we have not had it.

2723. Did they suggest that when you got it?—No.

2724. (Chairman.) Here is an inlet on the roof; there is a cloth with water round; there is a mat which is kept damp, and air passes through it?—We have not had any hot summers lately; we have never got above 80° in the shed. It is uncomfortably hot at 80°, but not unbearably hot. It is not a very hot shed like some.

2725. (Mr. Roberts.) Have you taken any records since you stopped this humidification?—Yes, we put them in yesterday. We did for a little while for the sake of curiosity.

2726. Have you copies of those that you took?—I know what they were yesterday: they were 63° and 59°; that is with no artificial humidity at all.

2727. (Mr. Roberts.) That is 77 per cent.

2728. (Professor Lorrain Smith.) Did you take them for a little while after you stopped humidifying?—Yes.

2729. Have you copies of those?—Yes, we have them somewhere. I can forward them to you.

2730. (Chairman.) Will you send them to Mr. Wilson?

(Mr. Shackleton.) It would be very interesting to have those figures.

2731. (Professor Lorrain Smith.) How much magnesium chloride do you use?—I could not tell you here the proportion; it is just enough for weaving. You cannot feel that the warp is damp or anything of that sort. It is not to be found in any way except by analysis.

2732. Have you had to keep the warp damper since you gave up humidifying?—Yes, they are a little damper I daresay.

2733. Both the light and the heavy?—Both the light and the heavy.

2734. (Chairman.) Did not I understand you to say, in answer to my question, that it was just the same?—The materials of the size are the same, but as the taper runs he does not dry the warp quite as hard.

2735. (Mr. Roberts.) It is not left on the cylinders quite so long?—It is not left so long on the hot cylinder.

2736. Are you troubled with mildew?—Very seldom; we get a warp just now and then, but not often.

2737. Do you use this chloride of magnesium in your light sizing?—Not at all; we could not do with it.

2738. Why not?—It would not do with the finishing; it might interfere with the finish.

2739. (Chairman.) Is there any statement that you would like to make to the Committee, or any suggestion that you would like to make, Mr. Temple? You are a practical manufacturer, and you know, just as well as we do, what all this question is about?—The main thing is that to comply with any standard of CO₂ you must have artificial ventilation, and if you have artificial ventilation you must have humidity. We do not seem able to get over that. We have tried, and have not been able to get over that. We were a very good shed, and the atmosphere of the shed was as clear as this room; no dust in the air, very clean and smart looking. We have not that now.

2740. When you say you must have ventilation, you mean mechanical ventilation?—Mechanical ventilation.

2741. (Professor Lorrain Smith.) Did you ever get over the difficulty of draughts?—They complained a little; the weavers just around complained of draught; but they did not wish to leave their looms; they were content to stay where they were; and, going in the shed, which I frequently did, I found nothing detrimental; I could not say there was any draught.

2742. (Mr. Shackleton.) Probably you would have your coat on, and your hat on?—Yes.

2743. (Chairman.) I think we may take it that with Hart's, or any other system of ventilation, if the person in charge is a little bit careless at times in the way of keeping the heating pipes up to a proper temperature, or not kept warm, we might expect complaints of draught?—Yes, if he did not keep it warm. Of course, I do not know of any other humidifiers, but we find that Hart's was very satisfactory; we could regulate; if the temperature was below freezing point we could always bring the air in at 60°. If the temperature was 26° outside we could bring the air in at 60°.

2744. (Professor Lorrain Smith.) This figure you gave us for yesterday, 63°-59°, is a condition good for weaving?—No, nothing like; it does not give the same results.

2745. Nothing like 68°-64°?—No; 63°-70°, with humidity, would change the condition altogether.

2746. You are up to 77 per cent. of humidity?—It is not as essential as if we were at 60°. The other seems more effective. I do not know whether it is the ventilation, or what it is, but it is more effective if there is humidity.

2747. (Chairman.) There is nothing more you would like to say?—Nothing more.

The witness withdrew.

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Mr. JOHN HOWARTH GREY, called in and examined.

2748. (*Chairman.*) You are the proprietor of what?—Director of John Grey, Limited, Livingstone and Cameron Mills, Burnley.

2749. Are you manufacturers and spinners?—No; cotton manufacturers only.

2750. How many looms?—2,305.

2751. What class of goods?—Printers, shirtings, twills, and sateens.

2752. Are those light sized goods?—Yes; all through pure size, except at very occasional times, we have made goods with about 20 or 30 per cent. on; but that is really what you might call light size.

2753. Have you formed an opinion as to whether it is necessary, for economical and efficient weaving, to introduce artificial humidity into the sheds?—Yes; I think it is.

2754. You think it is necessary?—Yes.

2755. Are you introducing artificial humidity at present?—No; we gave over in September, 1906.

2756. Why did you give over?—On account of the agitation that was going on at the time, and the large extensions that were being made in Burnley. We kept losing our workpeople, owing to the prejudice and the feeling that there was against the system at the time. So out of deference to that feeling we gave over.

2757. What system of humidification had you when you used it?—In Livingstone Mill we had Parsons' Humidifier, although ten years before that we had an old Howarth's Humidifier; but we pulled that out when the standard of CO₂ was reduced to nine volumes in 10,000. In Cameron Mill we had Matthews and Yates'.

2758. Are you able to say whether your output has in any way suffered since you gave up artificial humidification?—Yes.

2759. Could you give us any approximate idea—to what extent?—I was looking up some figures, and I found that the average from October, 1905, to March, 1906, compared with the average for a similar period—October, 1906, to March, 1907—was 3d. per loom less. It was about 1d. per loom less, because in that period the weavers had had an advance in wages of 2½ per cent., making it equivalent to a reduction in output of 3d. per loom per week.

2760-2764. Do you use the same class of yarn now as you did when you used humidity?—We use the same counts, and as far as we have been able we have got better yarn; we have got marks of twist which have cost more money, although during the last 12 months twist has been a very irregular quantity according to the quality of the crop.

2765. Have you found it necessary, in consequence of the abolition of artificial humidity, to use a better yarn?—Yes, slightly better, although we never used to go on this: that because we were steaming we would buy a cheap yarn; we used to think we would buy better yarn and get a better output; it was not so much what we saved on what we paid for yarn, as what we gained by increased output and a better quality of cloth.

2766. You told us, I think, about the size—that the size is the same now as you used all along?—Yes, the same class of size. We did make an attempt last winter to modify it in this way: We gave over steaming in September, 1906, so we made several experiments in the way of sizing to see if we could get at some method by which warps would extract moisture from the atmosphere, and at the same time endeavour to remedy the lack of that moisture through not humidifying.

2767. Have you noticed any difference in the purity of the air in your sheds since you gave up mechanical ventilation?—We never have given up altogether. During the summer months we reduced the speed of the apparatus by one-half, but we consider that the atmosphere is not so clear, and in summer the condition of the shed is not so sweet.

2768. In winter are you introducing a certain amount of outside air?—About one-half, in order to warm the place.

2769. Mechanically?—Yes.

2770. The air passes through what?—Hot coils.

2771. Do you think that you add to the comfort of the workers by doing this?—We think we can get the temperature up much more quickly during the early hours of the day.

2772. Have you had any complaints about draughts?—No. When we installed the Parson's Humidifier it was doing 360 revolutions a minute. We calculated by the anemometer that we were giving each operative between 2,800 and 3,000 cubic feet of air per hour. Mr. Williams came round and took tests, and reported that we were still contravening the Act. We took off the little engine that ran the humidifier, and installed a special drive from the shaft and increased the speed of the fan to 500. The speed was so great that we could not take anemometrical tests; it simply threatened to break the instrument by trying to take them; but we calculated that as near as possible we were giving between 4,000 and 5,000 cubic feet per hour, but certainly over 4,000. With the machine having been constructed to give a certain quantity, say about 3,000, which was considered quite sufficient, when we increased the speed by nearly 30 or 40 per cent. it got up an enormous pressure in the main trunk, from which branch pipes distributed the air. In these branch pipes there were little flaps that used to take out the air at a very acute angle, consequently those weavers who worked very near the main trunk complained of draughts, especially at the end of the shed where there was the greatest pressure of air in the pipe. With the pressure it came out quicker of course. We regulated those flaps, and since then we have had no complaints. With the Matthews and Yates' Humidifier we have never had any complaints. We used to have a few complaints with the Roger Pye machine that we had at the Elm-street shed. We no longer run that.

2773. You told us in the early part of your evidence that a great many of your weavers left you, and you assigned the reason that they did not like artificial humidity?—Those were the reasons that they gave. I do not know whether I said a great many; we had not a very great many, but we had several, and some of the weavers that had worked for us for years and years, and worked under this system perhaps 15 years.

2774. At any rate, some left?—Some left, and assigned that reason.

2775. Did you ask them their reasons for leaving?—Some of them, and we made inquiries from the overlookers.

2776. What did they say?—They could not stand the steam.

2777. We hear that in certain districts and in certain works that a ballot was taken?—Yes.

2778. Do you know anything about that ballot?—Yes.

2779. Did it take place in your works?—Yes.

2780. Are you able, from your own knowledge, to say exactly how the ballot was conducted?—Yes. These ballots were being taken all over the town at those mills that had artificial humidity. Eventually it became the turn of our mill. They took these ballots one firm at a time. Now, notwithstanding the fact that there was all this great what you might call opposition on the part of the operatives, before any voting was taken all our operatives were got together and addressed by the president and the secretary of the Weavers' Institution, and, so far as we can gather, instructed to some extent how to vote.

2781. Did you hear this, or is this to your own knowledge: are you able to say as a fact that this

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happened?—I can say as a fact that the weavers were got together, and that Mr. Fred Thomas (the secretary) and Mr. Robert Pollard (the president of the Burnley Weavers' Association) addressed them in the Abel Street Board School a few days prior to the voting cards being given out. Reports were that the meeting was held to instruct the weavers how to vote. On a certain morning a few days afterwards two of the representatives of the Weavers' Committee were at the mill door, and distributed cards. I have brought one with me, in case this might come up. They were giving them out *ad libitum* to those going in or coming out: grown-up people, young persons, or children. Children were running in and out of the shed, enjoying it, and saying that weavers in the shed wanted three or four more. Eventually, when the figures were published, notwithstanding the fact that they had been distributing, I should say, 20 or 30 per cent. more cards than there were weavers, the numbers published corresponded with the number of weavers employed at our mills; and I do not consider that it was a fair test, because each weaver was asked to put his or her loom numbers on the card, and was, to some extent, influenced into voting in favour of the abolition of steaming, as they were afraid of voting otherwise, in case their companions round about knew.

2782. Your suggestion, I take it, is that the union officials influenced the voting?—Undoubtedly.

2783. Can you assign any reason for their wishing to influence the voting. I mean, would it be to the officials of the union any benefit if steaming were done away with?—I do not know that I can assign any definite reason, beyond this: that they wished to get the vote overwhelming, practically unanimous; and at Burnley, in my opinion, the agitation on the steaming question was brought very much to a head by the Socialist element in the town, who had made this a test question during the Parliamentary Election. I will not intrude on political matters here; but I am just stating my opinion as to what largely led to this agitation. During that election this was brought very prominently to the front, and I think that weavers who had worked under steaming for years and years were given opinions that they had never formed by their own independent judgment.

2784. What I would like to try and get at is this: If any officials of any kind tried to influence a body of workers, they must have had some reason for doing it?—Yes; I take it that the reason was that they wanted a sufficiently overwhelming vote to enable them to appeal to the authority and say: We have all this opinion in favour of our demand for the abolition of steaming, and we think we ought to have our wishes carried out.

2785. Why should they wish to abolish it?—Because they think, in their own minds, that it is detrimental.

2786. Of course, if that is an honest conviction, it would not be an illegitimate thing to try and influence other people; whether it is a right or a wrong conviction we do not know?—No.

2787. (Professor Lorrain Smith.) You have not told us what you consider to be an ideal temperature for working at of the two bulbs?—I should say an ideal temperature for weaving is between 66° and 70°.

2788. And the wet bulb?—Of course, an ideal temperature for weaving is with the wet bulb as near to the dry bulb as you can get it; but I should say a nice weaving temperature is with the wet bulb between 65° and 70°, at 3° apart, that is, 3° below the dry bulb.

2789. That is to say, about 80 per cent. of humidity?—About 80 per cent. to 82 per cent. of relative humidity.

2790. Then there would be no discomfort, of course, working at those temperatures?—No.

2791. Have you ever thought about the question of trying to keep a shed in those ideal conditions in hot weather?—Yes. With our Parsons' machine we find that all through the summer months had we desired it—except on occasional days—we could come almost to the Act—by that I mean we could run almost to the schedule by blowing cold air through cold water sprays, very highly atomised, at about six or seven different points along the process of distribution. But we could not get as good results with Matthews

and Yates'. Had we chosen, we could have worked up to the schedule, almost.

2792. But how far could you control the temperature?—I daresay by that method we could keep the temperature down, say, two or three degrees.

2793. Below what it was outside?—No; below what it would otherwise have been, had we not been introducing air from outside. We could get better weaving conditions; and, as regards the condition of the atmosphere, it was cleaner, and certainly when the mill closed we considered it far sweeter than what it would otherwise have been. Of course, on very hot days, in order to assist that, we opened every door in the shed and every door in the warehouse, to give the freest access for the bad air of the shed to be driven out by the fresh air which we are putting in with our instrument. Returning to this first term of reference here, I have a few figures, if the Committee would like me to give them, of the temperature and humidity which answer in each case for the manufacture of cotton fabrics.

2794. (Chairman.) I think it would be very useful?—Unfortunately we have no figures really that we have taken before we ceased to humidify. These have been taken during perhaps the last nine or ten months by our weaving overlooker, a position which he has only occupied for 18 months or two years. He commenced taking these of his own accord for his own satisfaction. The method of taking them is this: He goes through the shed, walking down every alternate back alley examining every warp in every other alley, half the warps in the shed on each visit. Every Monday morning and every Wednesday afternoon he puts down the number of ends which he finds broken, and the dry bulb temperature in the centre of the shed in each mill. Now in the Cameron Mill, which contains 917 looms, the average for April, May, and June, 1907, of each what I may call perambulation through the mill was ends down or ends broken, 55·7. Now in April, May, and June, 1907, the average temperature in a dry shed without humidity was 69°.

2795. (Mr. Roberts.) You have not got the wet table?—No, we have not kept them. We have taken down the boards and not kept them going. The man took these temperatures for his own information. For the same period in the Livingstone Mill the number of ends down was 86·6, with an average temperature of 71°. The number of looms in that mill was 1,388; so that practically the percentage of breakages was about the same, taking the proportion of looms. Now for July, August, and September of the same year in Cameron Mill, the ends broken were 53·3, and the average temperature 71°. In the Livingstone Mill the average number of ends down was 87·2, and the average temperature was 73°. So that for April, May, and June, and for July, August, and September, you have practically the same with an average temperature of 70° to 72°. Now in November and December, 1907, and January, 1908, three months, in the Cameron Mill, the average temperature goes down from 70° to 62°, and the number of broken ends go up from 54 to 66·4. In Livingstone Mill the average temperature goes down to 64°; the number of ends down goes up to 103·3; that is, you have a reduction in temperature of 14 per cent., and an increase in the breakages of 20 per cent. That proves my contention that about 66° to 70° is the most ideal condition; and that below that in the winter months without humidity, you have much worse weaving. Now I examined the hygrometer reading for January, 1906, at Livingstone Mill, taken between three and four, and I find that the average for the month was 67·5° for the dry bulb, and 64° for the wet bulb, a difference of 3·5; or giving a relative humidity I think of nearly 80 per cent. Now in January, 1908, without humidity, in Livingstone Mill, the dry bulb average was 65° for the month, and the wet bulb 57·7, a difference of 7·3.

2796. (Chairman.) And the relative humidity?—That would be about 54 or 55 per cent. In Cameron Mill the temperature was 65·5° dry bulb, 57·5° wet bulb, a difference of 8°. Now for the month of January the number of broken ends in Cameron Mill averaged on the month about 69, and at Livingstone

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Mill they averaged about 110. So that the month of January was worse than the average of the three months, November, December, and January, on an average relative humidity of about 60 per cent. That proves, in my opinion, that the relative percentage of humidity between 60 and 70 or 75 per cent. is detrimental to weaving, and you ought to have at least a relative humidity of 75 to 85 per cent. to have good weaving.

2797. (*Professor Lorrain Smith.*) You have these hygrometrical readings for the dry sheds?—Yes, when we knew this Commission was going to be appointed, about the third week in December, we had a hygrometer in both sheds rigged up again, and boards put up and marked every day as though we were humidifying, for the purpose of making observations as to the differences.

2798. (*Chairman.*) Have you those tables?—These tables are at the mill.

2799. Will you send us copies of the tables?—Yes. They were taken from about the 23rd of December.

2800. (*Mr. Cross.*) I do not understand quite the average ends. Will you explain that?—It was this way, Mr. Cross. In going through the shed there are open alleys and pillar alleys. We will say he went through in the morning. He would take an open alley, afterwards he takes a pillar alley; so in a day he sees every warp. On Monday morning he would take the open alleys; on Wednesday afternoons he would take the alternate alleys. In traversing from one alley to the other, in going down an alley, if he found ten ends broken which he pieced, he would put down ten on a card. If in going down ten alleys altogether he found an average of ten in each alley that was 100.

2801. How long would it take him to go through?—Half the shed about three-quarters of an hour.

2802. Then those figures mean a one and a half hour's traverse?—For both sheds, that is if he went straight through and were not detained by a weaver to look at a bad warp.

2803. He would have 110 ends down in an hour and a-half's time?—No, 170.

2804. (*Mr. Shackleton.*) I just want to refer to that matter about the ballot which you so kindly referred to, Mr. Grey. You have the impression that the meeting of the operatives called by Mr. Thomas was not for the purpose of explaining the method of balloting, but for telling them how to vote?—To some extent.

2805. You have that impression?—Yes.

2806. Then the statement which Mr. Thomas makes here would not be correct, in which he says, "The special purpose is as follows . . . and especially to use their own judgment when giving their vote for or against steaming"?—No, my impression would be wrong if that is correct.

2807. That is Mr. Thomas's own statement. Now with regard to the question of number. You seem to have an idea that because the number of the loom was required that that was intended as a sort of pressure, that if they did not vote against steaming that would be recorded?—Yes.

2808. You do not know our methods, do you, at all: that is simply an outside impression?—I do not know them intimately; I have only a general observation.

2809. You are not aware that the method is that these cards are collected and no person outside the

office ever knows the individual opinion of any particular member?—No, I am not.

2810. I want you to understand that that is the method?—Do all the operatives understand that that is the method.

2811. Yes. That is the reason why the name is not asked for, and only the number. I want to know whether you are aware whether the number is asked for for the very special reason which you alleged, namely, that more cards were given than there were operatives?—No.

2812. And in order to test the accuracy of the ballot it was necessary to have the numbers of the weavers, and that all cards outside the particular numbers corresponding to your shed were cast on one side. (I am only raising this, Mr. Chairman, because the witness has indicated that that was for another purpose. I want the witness to understand that the number was given absolutely for no other purpose but to prevent a misuse of the card; and if 200 cards were given out more than were needed they were never counted). The figures are given as the result of the ballot at your Livingstone Mill, and I find one person voted for steaming, and 385 against. That represents the number of looms.

2813. (*Chairman.*) I think it would be perhaps more strictly in order if this gentleman made the statement. He ought to make his own statement as to the method. You noticed yesterday that some gentlemen made statements, and I suggested that we, as members of the Committee, should not make statements, but that we should get those statements in evidence.

2814. (*Mr. Shackleton.*) Then I will ask you, Mr. Grey, this. You say you have 2,305 looms altogether?—Yes, at both mills.

2815. If you deduct those at the Cameron Mill it would leave you about 1,300?—1,388.

2816. Then 1,247 and four would represent an overwhelming majority of the looms, would not it?—I do not understand that.

2817. 1,247 looms and four looms, that is those in favour, would represent an overwhelming majority?—Yes.

2818. Then you will agree that these figures published here prove the exclusion of those surplus cards you referred to?—Yes.

2819. (*Chairman.*) I do not think anybody can deny that the operatives had that feeling?—I do not deny that the feeling amongst the operatives is there, but what I was wishing to give the impression of was this: if the feeling was so strong, to me it did not appear to be so necessary that they should be so admirably coached in order to arrive at a desired result; and notwithstanding all that Mr. Shackleton has said I feel that whether the operatives' leaders had that intention consciously or unconsciously, it had to some extent that effect.

2820. Is there anything else you would like to say?—There is the point what special arrangements, if any, are necessary in order to admit of the proper ventilation of dry weaving sheds without prejudice to the process of manufacture. I do not believe there are any that would properly ventilate a dry weaving shed and bring it up to the standard of atmospheric purity which is required of a shed under the Cotton Cloth Factories Act without prejudice to the process of manufacture, whatever class of goods may be woven.

The witness withdrew.

Mr. GEORGE GREEN, called in and examined.

2821. (*Chairman.*) You are a manufacturer, Mr. Green?—Yes.

2822. What is the name of your works?—Jubilee Mill.

2823. Is that at Padiham?—At Padiham.

2824. Are you both spinners and weavers?—No, only weavers.

2825. How many looms have you?—1,208.

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2826. What class of goods do you make?—Fine goods from, say, forties upwards, mostly. We do a little in coarser counts as well, but principally cloth made from fine Egyptian yarns.

2827. I suppose you will have both pure and heavy size?—No, we have no heavy size; it is all pure sizing.

2828. Pure size right through?—Yes.

2829. Do you introduce artificial humidity?—Yes.

2830. And are you of opinion that for successful and economical weaving the introduction of humidity is necessary?—Yes, we think we cannot possibly do work successfully without.

2831. You think that you cannot possibly?—Not to be successful.

2832. You know, of course, that weaving is done in many parts of the country without artificial humidity?—Yes.

2833. Are you able to say whether the same class of goods that you make are made without artificial humidity?—I have a mill that I am interested in where they are made without it, but it is a rather fairly well situated mill for humidity naturally, and we cannot manufacture there with the same advantage that we can at the other place.

2834. And as to the output?—The output is less.

2835. Could you give us any statistics on that point?—Yes, I think so. I can only speak for the earnings, and that shows the production. At the mill without moisture the average this week is 6s. 2d. In the three other mills, where there is artificial moisture put in, it is 6s. 7½d., 6s. 6½d., 6s. 8½d.; the week before 6s. 2½d. for the non-humidified shed, and 6s. 8½d., 6s. 6½d., 6s. 8½d.

2836. In the non-humid shed?—No, the non-humid shed is 6s. 2d., and 6s. 2½d. the week before. The other three are all humid sheds.

2837. (*Mr. Shackleton.*) Are they similar goods?—Similar goods, but they might be slightly wider in the average.

2838. (*Mr. Higson.*) In which shed are they the widest?—There is one tackler in non-humid shed with the same width of looms as the humid shed, and the average is 6s. 3½d. against 6s. 7½d. for the humid shed.

2839. (*Chairman.*) Is the yarn used in both mills the same?—The same yarn; it is all taken out of the same deliveries.

2840. What about the sizing?—The sizing is the same.

2841. Then there is no difference of sizing whatever?—No; we may put a little less on, but practically nothing different; the mixing is practically the same.

2842. And you are using in most of your sheds artificial humidity?—Yes.

2843. What method?—In one shed we have Matthews and Yates' humidifier. In another shed we have a foreign one—Monks' hygrophor.

2844. What is the principle of that?—The principle is that the air passes over warm water, and there are a number of discs which revolve. It is really that the air has to pass over hot water in winter time, and over cold water in summer time.

2845. Is it forced through by a fan?—It is forced through by a plenum fan.

2846. And distributed through trunks?—Through trunks.

2847. Have you had any complaints from your weavers on account of the moisture?—Yes, we had a strike a couple of years ago I think it is, or something like that.

2848. With what result?—Before the strike took place we had not trunks to conduct it in the shed. It was let in at one inlet at each end of the shed. We trunked it off afterwards, and we have had very few complaints since.

2849. We have heard of a ballot of weavers. Was your mill one of the places where there was a ballot?—I believe so. I think all Lancashire was balloted, but I could not say anything about it; it is nothing that we had anything to do with.

2850. What do you consider to be the best temperature that you must have for weaving?—We consider from 67° to 72°, about.

2851. That is the temperature of the dry bulb?—Of the dry bulb.

2852. What would you have for the wet bulb?—At 70° we should say about 66°; that is the minimum that we should care to go down to. The nearer we can get to what is allowed by the Act of Parliament the better weaving it is. We do not grumble if we get to 70°–66°.

2853. You know probably, because it is now public property, that a very large proportion of the weavers object to artificial humidifying; they think their health suffers. They may be right or they may be wrong; that is not decided, and no one can say at present; but putting aside the health question, what do you think would be the effect on the trade in Lancashire or on the cotton textile weaving trades throughout the country were artificial humidifying totally abolished?—I should say at once that we should lose our pre-eminence in cotton weaving if artificial humidity were abolished; in fact, I myself should not like to be compelled to manufacture without it. We cannot get as good a quality of weaving; there are more breakages; we have more trouble with the cloth in a dry shed than we have in a humidified shed, and in a humidified shed you get better results both as to earnings and quality.

2854. Such a prohibition, were it ever made, you think would very seriously affect the trade in this country?—I do. There is one shed where I have no moisture. I really floated it to see what it would do on its own, because I am of opinion that we have been helping that shed with the others.

2855. You have told us that you have one shed where there is no artificial moisture?—Yes.

2856. Have you ever put the wet and dry bulb thermometer in there?—I have.

2857. What were the readings?—The readings would average on an ordinary day 70°–63°, and it has been much worse I should think in a dry east wind or on a frosty day.

2858. Because the ventilators would be closed?—Yes, and the natural moisture would not be as much quite.

2859. I take it that on what is called a bad weaving day—a day when there is an easterly wind, a dry day—the ventilators would be closed?—Yes; they would be closed.

2860. And the atmosphere would become more impure?—It would become more impure.

2861. And would contain, probably, more moisture?—In that case, you can never shut out all the air, by a long way; you must get some in. You must be affected by the outside temperature to a great extent; we find it so. You may say we have passable weaving at a temperature of 70°–63°. That is on an ordinary day. But if we come to a day with an east wind, the average goes down 3d. to 4d. a loom, and as much as 6d. We must get a drier atmosphere, though I have never tested it on those days.

2862. (*Mr. Higson.*) We remember the strike you had. It was in consequence of the humidity being infused into the shed at points too great a distance apart, and it got rather too humid in the immediate vicinity of the trunk end?—Yes.

2863. You have put trunks through your shed now to distribute it?—Yes.

2864. Have there been any objections since then?—No; not what you might call objections. There might be a representative come up and say, probably, "We are a bit too damp to-day," or something of that sort, when it has been a very mild day outside; but there

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has been no serious complaint. Or they might say sometimes, "It is getting too hot."

2865. But when the representative has come up to say that it has been a bit too damp have you exceeded the limit allowed by the Act?—No; the real complaint, the only complaint that I have had since was that the floors were slightly damp, and that was done when we got a little bit higher in temperature inside; we shut off the warm air and brought in cold, and it struck slightly damp.

2866. Do you regard your weavers as being fairly satisfied with present conditions when you work that appliance as you think it ought to be worked?—Yes, I should say so. I can only rely upon my opinion in this way: that we have less difficulty in getting weavers in humid sheds than we have in the dry shed; and anyone that has worked in a humid shed does not care to work at the dry one; for the sake of the earnings, I presume.

2867. (*Mr. Cross.*) Where you have that hygrophor—if that is the name—have you tested how much you could lower the temperature in summer time by the air being blown over cold water, and, if so, how many degrees, about, do you think?—Yes I have reduced it 4°. We can make that shed cooler in summer time than any of the others; but I find, if we do too much cooling, sometimes there are those complaints of a little draught. They feel it, and the weavers do not like to feel anything.

2868. What has been the highest temperature you have had in that shed in summer?—I could not be certain, but I think it was about 84°.

2869. That is the highest?—I should think so; I would not be absolutely certain.

2870. Could you say if that is the usual selection of the weavers in Padiham, that they prefer to go to the humid shed instead of dry sheds—because it has been testified here to the opposite?—I can only speak to what the managers tell me: that there are always more on the books ready to go into the humid shed than for the dry-shed, especially when there has been a scarcity of hands. We have had more difficulty in keeping looms going at the dry shed than we have had at the other sheds; and the same weavers that have worked at the humid sheds if they have wanted to come back again after having left, have preferred the humid. They would not care to go to the dry one.

2871. (*Mr. Roberts.*) They prefer a humid shed?—Yes.

2872. (*Mr. Cross.*) Do I understand you aright that in the dry shed in an east wind—we may have east winds starting, perhaps, in a week or two now and going on for weeks—the earnings are 6d. less?—6d. per loom.

2873. That is a lot, is not it?—It is. Of course, it would not get down by 6d. if only for a day or two, and then it broke; but if it went on for a few weeks it would reduce the earnings 6d. per loom per week.

2874. You have never had an average return of 6d. per loom less in any length of time when an east wind has been blowing?—I think I have; but I do not think I have the book here with it in.

2875. (*Mr. Shackleton.*) I want to ask you about these averages. They are rather interesting figures. There is the difference given of 5½d. and 6½d. between one and the other. Is that per loom?—Per loom.

2876. Would you attribute any of this to a less skilful class of operatives?—No; I do not say that I would. I think that at this shed we have quite as skilful a class of operatives as we have at the other.

2877. Is there any request from that shed to come to the other?—There have been requests from that shed, but we do not reckon to change, to take one from the other, or else we should probably have had more applications.

2878. How many sheds have you altogether?—Really, there are two; but the one of them is divided into three separate sheds.

2879. You have more than one system of humidifying?—Yes; we have three different systems at one place and nothing at the other.

2880. Three different systems?—Yes.

2881. What are they?—Matthews and Yates', the hygrophor, and the other is steam jets.

2882. Ordinary live steam?—Ordinary live steam.

2883. Do you find any difference in those three from the point of view of production?—You see in these three sheds I do not consider that I have quite as good a class of operatives—that is, in the shed where the Monks' hygrophor is. There was a new shed started when I had that strike on, and I lost a big proportion—say, 50 per cent. or more, of the workpeople there. You know, they have to get accustomed to a man's sorts. We take them from a coarse shop, and we find it takes some time to get them up to the old standard, and they have not got up to the old standard yet.

2884. Is the division you referred to a clear division, right to the roof, or is it merely a partition?—In one case between two sheds the division is right to the roof, made of boards; but there are strap holes through, communicating with the hygrophor shed and with the shed above, run by the Church Street Manufacturing Company, where Hart's humidifiers are in; and therefore we think that we get air from both those two sheds on each side as well as our own live steam; because in that shed we do not do a lot of steaming with regard to the jets, but we get sufficient moisture from those two to get it to what we like.

2885. You said something about having reduced the heat in summer by this system?—Yes.

2886. Was that a comparison of the shed itself, or between that shed and the other shed?—Between that shed and the other sheds.

2887. (*Chairman.*) What is your water supply?—My water supply is from the drinking water supply.

2888. That is what you use for steaming purposes?—Yes.

2889. (*Mr. Roberts.*) I think, Mr. Green, you have covered the case very well, but I will ask you this: have you any draughts from this hygrophor?—No, we have had no complaints of any draughts unless, as I say, we bring air in at a much lower temperature than the inside air.

2890. (*Professor Lorrain Smith.*) You might tell us a little more about that. You said when reducing the temperature 4° you were likely to have complaints about the draughts?—Slight. They can feel something sometimes, not often. I do not know how it is, but sometimes they can feel, and then they make a complaint.

2891. Does it amount to a serious objection or difficulty?—I have never had a serious objection. This is only my own opinion, but if I thought I could get it lower in temperature even than that probably I might have more serious complaints.

2892. Was it with the humidifier that you reduced the temperature 4°?—Yes.

2893. This was just blowing air over cold water?—Through it as well. With this hygrophor we can turn cold water on to the fan, and this fan breaks it up into fine spray, and it goes through that as well as over it.

2894. In winter you introduce hot water?—We heat the water with steam to about 30° C., or between 80° and 90° F.

2895. (*Chairman.*) I suppose the air is warmed?—Yes. The air is warmed also with the water. We warm the water between 80° and 90° F. or 30° C., as the machine has Centigrade thermometer fixed on it.

2896. (*Mr. Shackleton.*) You have two inlets, one at each end of the shed?—Yes, but it is conveyed by a trunk to each side, one trunk goes to one centre, and the trunks meet or one trunk goes an inch or two beyond the other. They just pass one another.

2897. (*Mr. Roberts.*) Which system of the three do you prefer?—As a humidifier, I consider the foreign one, the German thing called the hydrophor, the best, but I think myself that if I had to put another in, which I expect to do at Green Lane if things do not turn out satisfactorily to me, I should have a liking for the one of Mather and Platt.

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2898. The Vortex?—Yes, the Vortex. I think you can cool it there as well. I like the system. There is no doubt about the water system, in my estimation, being a good one.

2899. (*Chairman.*) Would you like to make any statement?—Only this, sir. That I consider it would be detrimental to the trade of this country and to our trade as manufacturers if we were prohibited from using steam.

2900. By steam you mean humidity in any form?—Humidity in any form, that is what I mean. I do not think that the objection of the workpeople is as serious as it is made out to be, or, if it is, it is prejudice on their part; because we find, as I have said before, that we have less difficulty in supplying hands to the humid shed than to the non-humid shed.

2901. (*Mr. Cross.*) After that I must just put another thought to you. Have you any figures or any information at your disposal which would indicate the number of workpeople who are off work sick at your humid shed and at your non-humid shed?—I am sorry to say that I have not; although I gave instructions for this to be done some two years ago. It was kept perhaps for a week or two, and because I did not ask about it again it was let slide, but we are under the impression that we have more off sick from the non-humid shed than we have from the humid shed.

2902. (*Professor Lorrain Smith.*) But there is no

marked difference?—I think there would be a marked difference if we took proper statistics. I intend doing it. I want to get to the bottom of this thing. I do not like to have workpeople upset by steam or otherwise. I intend to have full particulars on this matter later on. At present I have not got them.

2903. (*Mr. Roberts.*) May I suggest to you that you take those out at once, because they might be useful to the Committee before the Committee come to any decision upon this point at all?—Yes. What would you consider a fair average length of time to get a proper idea, gentlemen?

2904. If you began now, Mr. Green, and had it ready practically at any moment when we called upon you for the particulars, we could get it up to that date.

2905. (*Mr. Higson.*) Say six months hence.

2906. (*Mr. Roberts.*) It might be six months.

2907. (*Chairman.*) It would be better than nothing, but I do not think it would tell us very much.

2908. (*Mr. Roberts.*) It is worth having if you do not mind doing it?—I always thought I could not give a fair average unless I took it for 12 months.

2909. (*Professor Lorrain Smith.*) And even longer.

2910-2912. (*The Witness.*) We have different winters and different climates. You want it for as long as you can have it.

The witness withdrew.

Mr. ARTHUR HARRISON, called in and examined.

2913. (*Chairman.*) You are a cotton manufacturer, I think?—Yes, and I represent John Spencer, of Burnley.

2914. Your evidence will refer to that particular firm?—And to my own. I am a manufacturer as well. I was formerly manager for John Spencer (Burnley), Ltd.

2915. How many looms have you?—In the two mills we have over 2,000.

2916. Do you use artificial humidity?—Yes.

2917. In both mills?—Yes.

2918. How is the artificial humidity introduced?—It is introduced by means of pipes in tubes, steam with fans bringing in the air, then, of course, the air takes up the steam, carries it forward, and distributes it.

2919. What system is it known as?—Matthews and Yates'—that is in one mill. In the other mill we have Roger Pye's. It is similar to that of Matthews and Yates. They took it up after Roger Pye finished with it.

2920. Then it is steam, not water spray?—We use water sprays in the summer months.

2921. You can use either steam or water spray, whichever you like?—Yes.

2922. Or both combined?—Yes, both combined if necessary.

2923. Do you think that for satisfactory weaving, profitable weaving, it is necessary to introduce any artificial humidity?—Yes, also for this reason: that I should think during the greater portion of the year we have adverse weaving conditions. I consider that any weaving is affected by climatic conditions; and generally speaking to get a good result the year round some system of humidifying is absolutely necessary.

2924. I am not of course suggesting that it is running in the mind of the Committee that this should be done, for the Committee has arrived at no decision; we are sitting with open minds, and we hope to arrive at a decision later on; but supposing somebody

suggested to you that the trade of this country—I am talking now of cotton weaving—should be carried on without artificial humidity, what in your opinion would be the effect on the trade?—I think it would be very disastrous, for this reason: we are in competition now very largely with manufacturers abroad all over the world, and we find competition now is so keen that we must make the best article at the least possible cost; and by increasing the operatives' wages we try to get increased production. It is a well understood fact that weavers that earn the most money make the best cloth; therefore the more money they earn the more cloth they are making, and they are making it better.

2925. You probably know that in a large number of districts weaving is carried on without the aid of artificial humidity?—Well, I do not know what is done in a lot of districts. I know there are mills that do not use it. As to whether they are working satisfactorily, or what kind of cloth they do make, or whether it is satisfactory to them, I cannot say. I can speak for ourselves.

2926. Supposing somebody said to you that similar classes of goods were being made in two separate sheds, one with humidity and the other without humidity, and supposing it were said that it was satisfactorily done, how would you account for that?—I cannot account for that. I should say myself that the cloth made in the shed that had humidity would be better cloth in a good many respects, better woven, of a more even width and length, and I should say more of it generally.

2927. I am not talking of the present state of things in your mill, but have you any experience of weaving without artificial humidity?—Yes, a number of years.

2928. In the same mills?—In the same mills.

2929. Can you give us any reliable comparisons as to the results?—I cannot give figures; but we found that after we put artificial humidity into the mill we had more good weaving all the year round. I mean there are days through the year where the conditions are all that could be desired from a climatic point of view; on the other hand there are a great number

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of days when good weaving is absolutely impossible—I do not care what kind of yarn or what kind of work it is—I mean to say it is impossible to make good cloth.

2930. Is it impossible if you humidify?—No. By humidifying you can bring about the desired atmosphere that you require.

2931. We have heard that a ballot of operatives was taken, the ballot being to ascertain their wishes as to whether artificial humidification should be stopped. Do you know anything about that?—Well, it was not a ballot according to my idea of a ballot. I do not call it a ballot where people have to put their numbers on. In fact, at our place we found a number of ballot papers knocking about. I do not know whether they were reckoned or not. We found them after the ballot was supposed to be held. I do not know whether the workpeople were given two or three papers each, but anyhow we did find the papers; they were flying about the place. Then on the other hand I suppose each weaver had to number the paper.

2932. You must have had conversation with many weavers, and have had opportunities of discussing these matters; should you think from your knowledge of weavers that the weavers as a body object to artificial humidifying?—I do not think so—not if it is done on proper systematic lines. I think myself that the prejudice, if any, has arisen through humidifying with the old-fashioned idea of having simply steam jets and no ventilation as it was some years ago. The Act was altered some years ago, and we had to do it properly and ventilate; therefore I consider that a humidified shed with ventilation is far healthier from the workers' point of view than a shed without; particularly in the summer months.

2933. Do you think that the workers hold that view?—I myself have come across people that have found a benefit from working in what I call a healthy shed with humidifiers, and have told me that they had had better health, although there were humidifiers in the place. They did not say that it was due to humidifying, only they said that they had had better health. I put it down to the quantity of fresh air there was, and the air being so sweet generally.

2934. You have said that under proper conditions you do not think they would object to it, that is where the humidifying was done under proper conditions?—Yes, I mean to say a proper system. The chief objection that I have found was in some cases to draughts.

2935. We will put aside for the moment the official table. The official table was prepared by somebody else, and you have to go by it?—Yes.

2936. I should like to have your opinion apart from anybody else's opinion. What do you consider to be a suitable temperature for weaving your class of goods. I am assuming now that there is humidity?—I should say 65° to 70°.

2937. What would you say as to the wet bulb?—The wet bulb I should say from 3° to 4° below. If it is about 65° to 70° of temperature, that is about 78 to 88 per cent. of relative artificial humidity. Of course, personally I try to work a little on the lower side, so that there is no fear of getting above it.

2938. Have you had any personal complaints from your weavers at any time on account of the humidity?—No, I have personally been asked to put it in.

2939. You mean when it has been turned off?—I am referring now to odd times when we have thought we had sufficient. I mean to say without regard to the readings getting up, or anything of that sort, we have happened to have turned it off; the result has been for the time being that we have been bringing in raw air. Then we find the workpeople rather object to a draught. With bringing in air at a much cooler temperature than the air in the shed they have been working in they have felt a draught. In the later systems you can warm the air to any degree of heat you require. At the present moment we can turn the warm air into our sheds, not humidified air.

2940. You have worked under the humid system and under the non-humid system?—Yes.

2941. Did you find that it was necessary to have better yarn when you were working in the days when you had no humidifying?—In our case we did not make any difference whatever. We were using the class of yarns that we thought necessary for the class of goods we were engaged in. When we put humidifiers in or a system of humidifying, we never made the slightest difference; but we found an increase of earnings to the extent of 7½ to 10 per cent. almost at once; not only that, we got, I should think, 20 per cent. better cloth; more evenly finished cloth.

2942. You are not including the rise in wages?—No, I am referring to the particular time of year when we first put in humidification at the shed where we had no system of humidifying.

2943. You are attributing it to better manufacture, not to any rise of wages?—No, there was no rise of wages at the time I am speaking of. It was the depth of winter. I think everyone will admit that the difference between summer time and winter time weaving means fully 7½ per cent. in weavers' earnings in a non-humid shed.

2944. (Mr. Roberts.) What would be the effect supposing you were to stop your humidifiers to-day?—The effect at the present time, taking the time of the year into consideration in particular, would be to bring the earnings down.

2945. How much?—I should say five per cent. at the very least, to be on the under side; on the other hand, we should have considerably worse cloth.

2946. Upon which you would have to make allowances?—Yes. We are making enough allowances just now for cloth that we consider perfect. Of course, that is attributable to the state of the trade; it is not as good to pass.

2947. If you were to do away with humidity you would have variations in width?—Yes.

2948. And variations in length?—In length in particular.

2949. And if you were to do away with the present humidity you would have to allow more warp length?—Immediately.

2950. That is for the finished length of cloth?—Yes, the yarn would not stretch the same at all.

2951. Therefore the result would be that it would cost you more to produce the piece per quantity of yarn taken?—Yes; I may just add this: it is a general way with weavers that if the conditions are adverse for good weaving one of the first things they fly to is that they take a bit of weight off the warp. Generally speaking, we should have to put more length because the yarn would not have the same elasticity in the dry state.

2952. Therefore, you humidify for what purpose?—We humidify for the purpose of getting a better finished cloth, more uniform length and quality in particular. On the other hand you humidify so that when these so-called bad weaving days (to use a Lancashire term) come round, we can make on those days the same as on other days without upsetting the whole system of width and length. They vary according to the weather. I have found them to vary a lot.

2953. In your opinion, does humidification reduce the stretch in a thread or increase it?—It increases it.

2954. Thereby giving it more resistance to the working of the loom?—Yes; there is no doubt about that.

2955. (Professor Lorrain Smith.) Some manufacturers tell us they have given up humidity. You have not given up humidity at all in your experience?—Yes, we have given up the one mill. I cannot give you exactly the dates, but we gave up for a time. We found immediately a difference in width and length in particular; not only that, we found considerably worse cloth, and the weavers' earnings were less.

2956. Did they use wet cloths for damping the warp?—No, we have always had a strong objection to wet cloths, for this reason: we think there is a liability to mildewing after. We never allow that.

2957. Have you had any experience of cooling sheds in summer?—Yes, in both sheds we have cold-water sprays; that is a fine spray of cold water with good

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force on which is taken up by the fan, and the air leaves the fan cool. I cannot say that it brings the temperature down a great deal, only 2° to 4°, or something like that; but I must say this, that at night a shed that is treated in that way is far fresher, although it may happen to be nearly as warm as a shed that has been without. There is no smell on coming into it at night.

2958. There is nothing like the discomfort?—No, not at all.

2959. At what temperature do you think it begins to be uncomfortable to work in?—I should say it would be uncomfortable at from 80° to 85°. In a dry shed it will get towards 90° in summer time with a glass roof.

2960. Can they go on working in that?—Not with comfort, but they do go on.

2961. (*Mr. Roberts.*) That is in a dry shed?—Yes, in a dry shed certainly.

2962. (*Mr. Shackleton.*) I understand that you have a water spray in both those systems that you have?—Yes.

2963. And you use them frequently in the summer months?—We use them; as the day gets warm we put them on.

2964. Have you ever tested the difference between the heat of the place with the water spray and without it? You said the temperature comes down 4°?—We will say on a summer day when it has turned noon—we generally call the hottest period the time from then to three o'clock; when we have found there has been a tendency to get up in that direction we have put them on, and then we can either pull the temperature down or hold it stationary.

2965. Your real test is the comparative sweetness of the place as compared with the other?—Yes.

2966. You think that is well worth the extra cost you have put yourselves to in putting in that cold-water installation?—I say it is practically impossible to ventilate a dry shed; that is to say, you could ventilate it, but the weavers would not have it. They object to draughts, and they say it would make bad weaving.

2967. Is the Queen Street Mill one of your mills?—The Queen's Mill.

2968. And the Imperial Mill, is that another of them?—Yes.

2969. You have said that you did not know whether all the ballot papers were collected or not?—I found papers about after the ballot.

2970. Of course, there were more papers given out than were needed?—Probably.

2971. You said you do not consider it a ballot?—If one might put it that way. I mean to say, because of the weavers being told to put the number on; it was put there for someone to see how they voted. That is my meaning. I hardly call it a ballot.

2972. You do not think that Mr. Thomas or anybody else at the office would know a weaver at your mill by the number?—Possibly not; I do not think so.

2973. If the tabulation was made by somebody altogether apart from your mill, without any knowledge of the weavers or their numbers, you would not consider that that would have any influence?—In that case it would not.

2974. You can see the necessity of having numbers when you want to test the actual number of papers sent in?—Yes.

2975. You want to locate the weaver to the number?—Yes.

2976. You said some of the weavers had expressed themselves favourable to humidity?—Some of the weavers have come and asked for work on account of the humidifiers.

2977. You know the result of the ballot at your Queen Mill?—I know the result of several mills.

2978. Your own mill, I mean?—No, I do not know the figures, or anything of that sort.

2979. Would you be surprised to know that at your Queen Mill and the Imperial Mill only three expressed themselves as desirous of having steam?—No, I should not express any surprise.

2980-2981. Still, you would not consider that a very big proportion out of 300?—No.

2982. 282 against it, two for it in your Queen Mill, and one for it and 206 against it in your Imperial Mill; that is about the total number of your weavers; you have not any more than that?—We have more than that at the Imperial and less than that at the Queen's Mill.

2983. 284 weavers altogether?—Yes.

2984. The looms represented are just six less than your total number, or every weaver within two voted?—The figures are not right for the Imperial Mill, because there are only 20 looms different between the two places.

2985. Taking the number at the Imperial Mill, there were 100 looms not accounted for?—That makes it right.

2986. I want to make it quite clear. That expression of opinion by weavers to you did not seem to be borne out by their ballot vote?—It does not seem to be borne out, but still I can quite understand that.

2987. You do not think there was any pressure used, do you; the weavers would absolutely please themselves?—I can hardly say that. I think this: that there would be a certain amount of canvassing amongst them.

2988. Each side would do that?—I do not know as far as each side.

2989. I mean for and against?—We are for it, but we have never interfered in any shape or form.

2990. You reckon then that the weavers are against it if you are for it?—Yes, according to that ballot. I am speaking of the ballot.

2991. (*Chairman.*) Would you like to make any suggestion or any statement at all to the Committee? We shall be very glad to hear anything that you would like to say?—I suppose it is one of the coming things that a weaving shed, that is, a dry weaving shed, will have to be ventilated, and if they have to be ventilated, that is a sure way of making humidifiers absolutely necessary; there is no doubt about that.

2992. By which you mean that a standard of ventilation could not at all times be maintained unless a certain amount of humidity were allowed?—It could not be done.

2993. I mean weaving could not be carried on?—The weavers themselves would not have it. If you started ventilating a dry shed, and you drove air off, you would drive off the natural moisture in the yarn and in the place generally. Then if you bring in air you might be bringing a big quantity of air in with the wind in the east, and that would help your weaving considerably the wrong way; they would soon complain and want the fans stopped, I can tell you.

2994. (*Mr. Roberts.*) Supposing you were to stop your present system of humidification and were compelled to ventilate to the extent of 12 volumes of CO₂ in 10,000, what would be the result?—We should be brought to a standstill.

The witness withdrew.

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Mr. JOHN DUCKWORTH, called in and examined.

2995. (*Chairman.*) You are a manufacturer, Mr. Duckworth?—Yes.

2996. What is the name of your works?—The Roe Lee Mills, Blackburn; No. 1 and No. 2, Carr Cottage, Blackburn; and Waterloo Mill, Clitheroe.

2997. You know, of course, that in certain quarters objections have been made to humidifying?—Yes.

2998. What is your opinion as a manufacturer: is artificial humidity necessary for successful weaving in this country?—To my mind most decidedly.

2999. Were it suggested that artificial humidity should be prohibited by law, what, in your opinion, would be the effect on the cotton weaving trade of this country?—My opinion would be that there would be considerable reductions in wages, and work would not be nearly so good, and there would be great dissatisfaction all round. That is my candid opinion.

3000. Do you think that it would send any trade abroad?—It would certainly curtail the production here to a great extent.

3001. In your mills, the names of which you have given us, are you using at present artificial humidity?—Yes.

3002. In all of them?—In all of them.

3003. What systems?—Steam jets.

3004. Simply jets?—Simply the old jet system.

3005. Have you ever tried any atomising of water system?—No, we have not. The last new mill that we built has the jet system. Our manager went into several other things, and he came to the conclusion that the old jet was the best, taking it all round.

3006. Have you had any complaints from the workers to the effect that the steam causes them any inconvenience or injures their health?—To my knowledge not a single one.

3007. It is common knowledge I think that there was a ballot taken of the weavers, and they were asked to say whether they would like to see steaming done away with altogether. Did you hear of that ballot?—I am not sure whether it has been taken in Blackburn.

3008. Have you any knowledge of its having been taken in any of your own works?—No, I never heard it mentioned in our works; in none of our mills that I am aware of.

3009. You say you have had no complaints from your workers?—No complaints have reached me.

3010. How long has this steaming been going on?—Twenty-one years.

3011. (*Mr. Roberts.*) Not in all these sheds?—No, we have always had steam in the same way, but we have not always had four sheds.

3012. (*Chairman.*) But you have always manufactured on the steaming system?—Yes, it is twenty-one years since we commenced manufacturing.

3013. What class of goods do you manufacture?—Light sized.

3014. Light sized goods. What are the goods?—Ours are mostly muslins and fancy cloths, brocade—all varieties of light sized goods.

3015. And you are of opinion that your trade could not be satisfactorily carried on were humidity stopped altogether?—Most certainly.

3016. What amount of humidity do you consider necessary for successful weaving in your own particular branch?—I have taken a fair amount of interest in our own sheds in that respect, and we have generally found as far as the dry bulb is concerned, that is for warmth about 70°, and the wet bulb as near as we can get to that without a breach of the law, that is 67° to 68°, 67° I should say. That is about our experience. We have always seemed to do better, and things have gone on more smoothly when we have got to that point.

3017. A temperature of 70° and 3° between the bulbs?—Yes, not more than three.

3018. That you consider to be a good state of things for weaving?—Yes, from my own experience at my own places.

3019. Have you ever had reason to suppose that the workers suffered from excessive heat in summer?—No, I do not know that I have. It does get rather warm in summer sometimes.

3020. In your opinion does the use of the live steam increase the heat rather?—Yes, it is bound to do a little bit; I cannot say to what extent.

3021. Have you ever made any tests or done anything to ascertain at about what temperature the steam enters the shed?—No, I do not know that I have.

3022. What size are your pipes—not the heating pipes—the steam pipes?—I think they are either an inch or an inch and a quarter. I am not sure.

3023. (*Mr. Roberts.*) I should think an inch and a quarter, by the look of them?—They are well covered.

3024. (*Chairman.*) With what material?—The best we can get of the kind. There are many compositions.

3025. You are not able to say exactly what the non-conducting material is?—No.

3026. Are there any joints, or angles, or places where the pipes are not covered?—No; I do not think there are. The inspector is rather particular about that.

3027. What is the state of the floors, generally speaking—we know it must vary from time to time, but, generally speaking, are the floors dry or are they wet?—No; they would not do to be absolutely dry. There is a certain amount of dampness at times about. A great deal depends on the weather.

3028. Do you ever find anything beyond a mere film of moisture: do you find little puddles, or ponds?—No.

3029. No accumulations of that sort?—No, unless there has been something wrong with the jet.

3030. In the normal state of things you do not find any accumulations like a little pool?—No; if we find anything wrong with the jet we get it corrected as soon as possible.

3031. (*Mr. Roberts.*) What would be the effect, supposing you were to turn out steam altogether: that is to say, supposing it were prohibited, what would be the effect on the work in your sheds?—You mean upon the quality?

3032. Both quality and quantity, and any other thing that you can tell us?—Of course, I could not tell you as regards quantity; it is merely guesswork; I should think it would be shillings a week.

3033. Put it in a percentage, if you can?—I should think well on to 15 per cent.

3034. That is lessened production?—Yes, if it were prohibited entirely.

3035. What about the quality?—It would be very poor.

3036. What would be the result of that poor quality when you delivered your cloth?—There would be claims for inferior quality; no question about that.

3037. What would be the ultimate effect, probably, on your trade?—The ultimate effect would be that it would be a lessened trade.

3038. You would have a difficulty in selling your cloth?—We should have a difficulty in keeping the looms going.

3039. What system of ventilating have you where you have the steam jets?—Gregson's fans.

3040. Are they bringing air in or taking it out?—Half and half.

3041. Half exhaust and half the other way?—Yes.

3042. Have you ever tried anything to reduce the temperature of the air on the hot summer days of the year?—No, we have done nothing; only just the white-washing of the windows, in the usual way.

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3043. You have not tried bringing in the air through those fans, to cool it in any way, so as to bring down the outside temperature?—No, we have not experimented with anything of that sort.

3044. Have you heard of anybody else trying that?—No, I have not.

3045. (*Professor Lorrain Smith.*) I understand there are no complaints, practically, with regard to the humidity?—None have reached me. I have not heard of any, and I spend a great deal of time in the shed myself. With the exception of Tuesdays and Fridays, I am always in and out and about the shed, and if there are any complaints they are drilled up to lay them before me.

3046. You are in a position to hear complaints?—Yes. They are always told not to be afraid to lodge any complaint; a complaint from any of our work-people has our prompt and best attention.

3047. You have mechanical ventilation, I suppose, at present?—Fans.

3048. Do they complain of draughts?—No; I do not know that they do.

3049. (*Mr. Shackleton.*) What kind of cloth do you make?—All sorts of brocades and dobby cloths, lenos.

3050. Do you make any sateens?—Yes, a few sateens. We have some going now.

3051. You say unless you had the humidity you could not get the quality?—I feel quite sure of that.

3052. Can you tell me how they manage without steam in Nelson and other districts, and yet get the quality?—I could not. That district is foreign to me.

3053. You know they make sateens very largely?—Yes, I have heard Burnley manufacturers speak quite differently to that about getting quality or quantity either.

3054. Burnley is not a sateen district. I am talking about Nelson now?—Ours is a mixed trade altogether, still it is all pure size; it is a very varied class of cloth.

3055. Of course you know that Nelson is mainly a sateen district?—Yes.

3056. And they do without steam?—I could not say.

3057. They get the quality required; they go ahead with it, do not they?—I do not know. I do not know much about that.

3058. You know that Nelson has gone ahead?—Yes.

3059. It has gone faster than Blackburn, has not it?—As far as building mills.

3060. All on one kind of cloth, principally the sateen trade?—Yes.

3061. Now, in regard to the opinion of the weavers, you said you had not heard about the ballot?—If I have I have forgotten anything about Blackburn.

3062. You are perfectly right in saying there was no ballot at your mill; it was not a mill ballot; it was a general ballot of the town. You do not know the result of that ballot?—No. If I have known it I have forgotten it.

3063. (*Chairman.*) You say it was a ballot of the town; how did they get at that?

3064. (*Mr. Shackleton.*) Through the homes of the workpeople.

3065. (*Chairman.*) Was that in some particular town?

3066. (*Mr. Shackleton.*) All over, except Burnley.

3067. Burnley was the only place where it was a mill ballot. All the rest was a town ballot. The method was this. The collectors of the district took the voting papers round one week and collected them another week, and there was no name or number in that case, because there was a guarantee that they were every one members of the Society. (*To the witness.*) You cannot make any comparisons at your mill as to the effect on production, seeing that you have always had steam?—No, we can tell the difference when there is a very nasty east wind; we can see that the production is diminishing then. If it is a very nasty day we can tell even though we are steaming, because we cannot get the same effect with

the steam. We can see that there are a lot more looms standing than on a nice humid day like to-day.

3068. You cannot give any test except isolated instances of that sort?—No, we cannot.

3069. Your 15 per cent. reduction in wages seems to be an outside figure?—I am putting it in this way. Our production is, roughly, 30s. on four looms. I should say they would drop four or five shillings of that if they were absolutely without steam, taking an average of the year round.

3070. If a manufacturer were to say that the actual difference between a wet and dry shed in the same mill was only 5 per cent., what should you say to that?—I could not contradict him.

3071. You are giving your impression?—That is my impression.

3072. I am pointing out that your impressions do not tally with actual experience.

3073. (*Mr. Roberts.*) I may say here that other witnesses have stated that the production would only go down 10 per cent. if we did away with humidity, whilst others have said 5 per cent.?—This has not occurred to me before coming in here. I feel sure it would mean a reduction of about four to five shillings per week if steaming was prohibited.

3074. (*Chairman.*) It is a speculative question, and we must expect a variety of answers.

3075. (*Mr. Shackleton.*) With regard to the ideal conditions that you speak about, 70° heat, 67° wet bulb, is that your usual figure in your mill?—No, we cannot always keep at that, but we try to get as near that as possible.

3076. In the hot season have you never heard complaints, say, on a very hot day, of it being too warm?—They might say, "It's very hot," but we have had nobody to come up to lodge a complaint. By lodging complaints I mean nobody has come into the office or complained to me. In going through they might say, "It is very hot to-day."

3077. What is your impression on going through the shed at four or five o'clock on a summer's afternoon: do you think if anything could be done to reduce the heat it would be a good thing?—Yes, if we could reduce it without interfering with the work it would be a good thing.

3078. You put work as the first consideration?—Of course, I think it is.

3079. If you could get the same relative humidity with a cooler atmosphere you would not object?—No.

3080. If you could get that relative humidity you speak of with 82° instead of 90°, possibly on certain hot days you would not grumble?—No.

3081. (*Mr. Roberts.*) How many looms have you?—2,400.

3082. Can you tell us, roughly, how many of those are weaving sateens?—Perhaps 60, and that is only just recently.

3083. You have only 60 looms weaving sateens out of 2,400?—That is all.

3084. Those being amongst the 2,400, they have to put up with the same amount of humidity as the remaining 2,340?—Exactly.

3085. So it is quite possible you might be able to weave with those 60 looms if you could put them in a room by themselves without the same amount of humidity?—Yes.

3086. Even successfully?—Yes.

3087. But you cannot sacrifice the good work of 2,340 looms for the sake of 60?—No.

3088. Therefore you do not wish the Committee to understand it is impossible to weave sateens without artificial humidity?—No.

3089. But it is impossible for you to work the very large bulk of your trade without humidity?—Yes, most decidedly.

3090. (*Mr. Shackleton.*) I would like to ask you, do you generally keep your shed up to about 3° down?—I do not know whether we get the full average 3° down. It is rather difficult to keep it there. I think if I were to say, taking the average all the year round, it would be 3° to 4° down. We certainly aim to keep it at about 3° because we find it does better.

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3091. (*Chairman.*) We shall be very glad to hear any statement from you.

3092. (*Mr. Roberts.*) Can you give us your impressions as to what would be the ultimate result of weaving without humidity or anything of that sort? You know what this Committee have to consider. You know what the conditions of reference are: to find out if there is anything that causes discomfort to weavers, and what can be done to remedy it. If you think there is any discomfort caused to weavers, and you can make any suggestion to help the Committee to come to some decision upon it we shall be glad?—Candidly, it is utterly impossible to do without humidity altogether in my experience; utterly impossible. It would simply mean that the shed would be stopped, and I feel satisfied that the weavers would be up in arms; they could not possibly go on. The only thing which is a little bit against steaming in old sheds to-day, I daresay, is having to hang up their clothes in the steaming shed. In new sheds we have cloakrooms provided and boarded beyond the steam, and everybody has clean dry clothes to put on

when they come out. That is the only suggestion I can make as regards improvement, but it could not be done in old sheds.

3093. Why could not it be done in old sheds?—Most of the sheds have no ground. We could not do it in our old sheds. As a rule they are built up; they are built all round; there is no room for extension.

3094. (*Mr. Shackleton.*) There is no Garden City about them is there?—No.

3095. (*Chairman.*) I was going to ask whether the time has not come when that should be universal. I take it that the answer is that in many cases they have not space?—They have not space. You see, this yarn is sized; it must have some humidity to make it weave; if you go in a shed and follow it week after week, you can note the difference according to the weather. On a cold, dry, east windy day it takes you all your time to get along, even with all the steam you can put in. It is utterly impossible to weave yarn without a certain amount of heat and humidity. I can only speak from my own experience.

The witness withdrew.

SEVENTH DAY,

Thursday, 27th February, 1908.

At Manchester.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
Mr. H. HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

Dr. JOHN SCOTT HALDANE, called and examined.

(*Chairman.*) Gentlemen, I need not say that we all appreciate very highly Dr. Haldane's kindness in coming here to-day. We have, each of us, received an epitome of evidence* which I understand Dr. Haldane is prepared to give. I think perhaps it would save time if we took that as read. I think we all of us have read this epitome, and we agreed that it should be printed in our report, either in appendix form or in the body of the report, as may hereafter be decided; and I propose to ask Dr. Haldane certain questions which will, I think, perhaps explain his views more clearly, and I would ask the individual members of the Committee if they will do the same. Is that course agreeable to you, gentlemen? (Agreed.)

3096. (*Chairman.*) Would the course that I have mentioned be agreeable to you, Doctor?—Yes.

3097. Will you give the reporter your qualifications?—M.D., F.R.S., Fellow of New College, and Reader in Physiology, University of Oxford.

3098. You mention that your attention was drawn to the health of Cornish miners and to factory ventilation, and that you have made numerous observations and experiments on these subjects?—Yes.

3099. Those observations are chiefly embodied in the Report on the Health of Cornish Miners (Parliamentary Paper, 1900), in a paper on the Effects of High Air Temperatures, Journal of Hygiene, 1895, page 494, and in the Second Report on the Ventilation of Factories (Parliamentary Paper, 1907, page 6)?—Yes.

3100. (*Mr. Wilson.*) I could not get the Cornish mining paper.

(*Witness.*) I have the Cornish mining paper. I think practically all the facts relating to effects of

heat and moisture in that Cornish mining paper are in this copy of the Journal of Hygiene. I have brought copies of them, if they are of any use.

3101. (*Chairman.*) I think as a result of those experiments you come to the conclusion that in very warm air it is the temperature indicated by the wet bulb thermometer, not the actual air temperature as shown by the dry bulb thermometer, nor the amount of moisture in the air, nor the relative humidity which determines the ill effects produced; it is that with a wet bulb temperature exceeding 88° to 90° in fairly still air the body temperature begins to rise, even in the case of persons stripped to the waist and doing no work; and when once started this rise continues until symptoms of heat-stroke arise, unless the person leaves the warm air?—That is so.

3102. That summarises those conclusions, I think?—Yes. Perhaps I might draw attention just now to the chart* which I have here showing some of the effects. I do not know whether it is worth while putting this in the printed evidence.

3103. I think it would be very desirable?—Then the chart could be copied. Unfortunately, it is on the Centigrade scale. This chart represents observations of the temperature of the body, that is the rectal temperature, which is the best guide to the actual temperature of the body during exposure to warm air of different temperatures and different wet and dry bulbs. I propose first to draw attention to this tracing which shows the effects on the body temperature of staying in a wet bulb temperature of 94°. The pencil is degrees Fahrenheit. This was saturated air at 94° in a Cornish mine. The experiment consisted simply in staying quite quiet in that atmos-

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phere for about an hour and three-quarters, and watching the body temperature. You see it went straight up. When it got to 104° before the end of the experiment, it had to be stopped, as it was rising rapidly, and the effects were rather unpleasant. Here again is shown the effect of staying in an atmosphere with the wet and the dry bulb both at 89°. You see there is a very slow and gradual rise of temperature; but it goes on, and was going on, still rising, at the end of two and three-quarter hours.

3104. That is saturated air?—That is saturated air at 89°, both the dry and the wet bulb being at 89°. Then here is an experiment in which the wet bulb was just half a degree lower, but the dry bulb was 133°, and you see the effect of this on the actual body temperature, which was a little higher than usual at the beginning from walking about before the experiment. The temperature fell a little at first, then it rose again, but at the end of over two hours there was no change in the body temperature; that is to say, although the dry bulb was up to 133°, yet with the wet bulb below 89° the body temperature practically did not rise. All these particular experiments were done on myself, stripped to the waist, and doing no work. If work was done during the experiments, still stripped to the waist, the body temperature went up at a lower wet bulb temperature than 89°; in fact, it went up rapidly with fairly hard work with a wet bulb temperature of 80°, the work being the climbing of a step ladder; and I came to the conclusion, from these experiments, which were repeated on other individuals, on which they acted very much the same on the whole, that hard work at a temperature of over 80° wet bulb was practically impossible, but that the dry bulb temperature did not matter at all so long as the wet bulb temperature did not go up. It did not matter, really, then, what the dry bulb temperature was; the whole effects depended on the wet bulb temperature, and with a person resting stripped to the waist the critical temperature was about 89°. With a lower wet-bulb temperature than that the rise of body temperature simply depended on the amount of work done, and on the amount of clothing which a person had on; but a man stripped to the waist was under the most favourable conditions for work.

3105. (Mr. Roberts.) Mr. Chairman, if we allowed this evidence to go on, then a point might be forgotten, so perhaps I might interrupt here. (To the witness.) These temperatures, I presume, were taken upon yourself, or someone who was along with you, as experiments?—Yes.

3106. But what about the temperature of those who were actually working under such conditions in these tin mines; had they become acclimatised to it?—They had become accustomed to deal with it, and I will just explain how things worked out in a mine where some of the highest wet bulb temperatures we met with were found. In the particular mine I am speaking of, where I was most affected by the wet bulb temperature, I had been there I do not know how many times—five or six times—I have always looked to see whether I could ever find a man at work, and I never have yet, except in the neighbourhood of a rock drill, where the compressed air was escaping freely. Of course, they did work, I do not deny that; but the amount of work done was extremely light.

3107. Did you ever take the temperature of those men?—Yes; I found the temperature normal in a man working a rock drill in a very hot place; but, of course, he had a good deal of air escaping from the rock drill. In a man working at over 90° I found the temperature up.

3108. Over 90° wet bulb?—In a man working at one place, where the temperature was, I should think, 95°, I took the temperature when he had been about an hour at work; it was about 102° when he came out.

3109. Was that 95° wet bulb?—I think his temperature was 102°—I am not quite sure—it was up, at any rate.

[The note of this observation was: "Took temperatures of two miners who had been in the end for nearly an hour mending an air-pipe, and were coming out to 'cool off.' In each the mouth temperature was 101·6°." The normal mouth temperature is 98·6°.]

3110. In the temperature there you refer to the wet bulb?—Yes, the wet bulb. I should explain that in these Cornish mines the air was saturated everywhere, so it did not matter which I took.

3111. You spoke of a day's work. I have had your paper. In your remarks you spoke of a day's work. What do you estimate is a day's work, for a navvy say? I will explain why I ask the question, because that will be fairer. It seems to me the work you did was in ascending—I think it is that. "As J. S. H. weighed 185 lbs. the work done per minute in ascending was 2,590 ft. lbs." I make that out to be 350 ft. tons for five hours work, which is a very very big day's work in five hours?—It would be to have that work continuously for five hours. It would be a very big day's work.

3112. So that it struck me that doing work like that at that rate your temperature would naturally go up?—It does not go up; if it is cool, as you see, the same work done at a slightly lower temperature does not send the body temperature up in the same way; it goes up a degree or two and then stops.

3113. Still it is a big day's work to be done in five hours?—It would be; but it is less work than a man naturally does for a considerable period of time; for instance, in a coal mine a man has to work very hard while he is at it; in ascending the ladders from one of these tin mines a man is doing a great deal more work in the time, and he may take half to three-quarters of an hour to come up.

3114. In your experiments in these mines I am not to understand I presume that the temperature of the workers goes up in the same proportion or in the same degree as the temperature of those who were experimenting?—No, I do not think so; the temperature does not go up because they take care that it does not. A man who is working for instance in a tin mine takes very good care not to work except to a very slight and moderate extent; that is the whole art of working in one of these tin mines; and the men expect an enormously higher rate for any piece of work done. The work is paid by contract, and they get those higher rates, and they do very much less work in the time.

3115. That is all I want to ask you on that point.

3116. (Chairman.) Thank you very much. Have you anything further to say here?—No, I think this chart explains itself.

3117. I presume we may take a copy of this to go with the report and to put in our minutes?—Yes. I think it is probable that some men accustomed to very hot places would not be quite so much affected as I was. The chief difference is that they take care not to overwork. It is exactly the same in coal mines or any mine. Of course in a coal mine it would be quite impossible to go on with the mining under such conditions; but working very rich tin ore it is possible to make the mine pay.

3118. You make reference to schedule 4 of the Factory Act, and you are doubtless well acquainted with that schedule. I should like to ask you, Dr. Haldane, if you have any knowledge as to what was running in the mind of the framers of that schedule when it was drawn up; whether for instance it was drawn up on any actual experiments in regard to the effect of heat and temperature on the workers, and bearing in mind also manufacturing necessities, or on what principle was it drawn up?—I have often wondered myself. I have not been able to find that out, except that I infer that there was some idea running in the minds of the people who drew up the schedule that a high temperature was unpleasant for the workman, and that it was better to try and avoid that by making the conditions unfavourable for work at high temperatures, that is for the actual carrying on of the weaving. You see the higher the temperature the lower the relative humidity becomes; so that it would be a disadvantage to the manufacturer to work at those high temperatures.

3119. I think if we could just refer to Mr. Scudder's evidence on this point and read it to you we might ask you to give us your opinion upon that. You probably know Mr. Scudder?—I know him very well by name.

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3120. He was associated with Sir Henry Roscoe in his work for many years, and probably knows as well as anybody what ran in Sir Henry Roscoe's mind?—I think this schedule was not drawn up by Sir Henry Roscoe's Committee; it existed before that Committee.

3121. I will read to you what Mr. Scudder said. *Reading from Mr. Scudder's answers to Questions 9, 10 and 11 to the words "gets a chill."* I gather from that that what they had in view was to prevent a chill. But that does not seem to be the whole question at first, but only a very minor part of the question?—I think that is a minor question of high temperatures. I think it is very important at low temperatures. I think the regulation that there should be always 2° of difference between the wet and the dry bulbs is an excellent provision, because it prevents to a large extent the clothes from getting damp in any way from moisture in the air of the room. What it does not do is to prevent the clothes from getting wet from perspiration if the wet bulb temperature is too high; nor does it prevent the feeling of extreme lassitude and discomfort and weariness which affects a man when the wet bulb temperature is very high, or guard against a rise of body temperature which may occur.

3122. Here is a statement which it seems a little bit difficult to understand: "If you are in a weaving shed at a temperature of 80° and the saturation is 88 per cent., and you walk out into a shed at 60°"—that is a difference of 20°—"and the saturation is 88 per cent."—that is the same—"you could not tell one mill from another"?—I must strongly differ from that statement. Might I refer to Glaisher's Tables, and we will see what that means. At a temperature of 80° and a saturation of 88 per cent. the wet bulb temperature would be about 78°; whereas at a temperature of 60° and a saturation of 88 per cent. the wet bulb temperature would be about 58°, a difference of 20°. I can answer for it that the difference to one's comfort is enormous. In one case one is soaked with perspiration, and feeling very limp and flabby; in the other case one is perfectly well and comfortable.

3123. I will just read this carefully again, because it seems an important point. "I am now dealing with the effect of humidity. This is the principle I want you to realise, and it takes a lot of consideration. Supposing you are in a humid weaving shed with a percentage of saturation of 88 and you are in an atmosphere of 75°, and you go into an atmosphere at 60°, but with a saturation of 88 per cent., you feel no effect. The moisture is solely responsible for the chilling effect produced. If you are in a weaving shed at a temperature of 80° and the saturation is 88 per cent. and you walk out into a shed at 60° and the saturation is 88 per cent., you could not tell one mill from another, or if you opened a side door and slipped into another room. I want you to follow that, because that is one of the first things I would like you to satisfy yourselves of as a comment: that if you are in a place at a high temperature with a relative humidity of 88 per cent., and you leave that chamber and go into a room where you have a saturation of 88 per cent., but a lower temperature, you do not feel any chill."—I am afraid I entirely differ from that statement, and I want to point out in the most distinct way that the relative humidity is not what determines the effect on a man.

3124. That is why I am asking these questions?—In the one case with a wet bulb at 78° the man would be perspiring; would get in time very uncomfortable if he were in ordinary clothes; he would be fairly all right if he were in very light flannels or something of that sort; but in his ordinary clothes he would be perspiring and wet.

3125. (*Mr. Roberts.*) Even in moving air?—If the air were moving very rapidly I think he might be all right; but I am talking of air of an ordinary room where there is a certain amount of movement, but not very much.

3126. The air will be changed?—I quite understand, but I call the air of a shed pretty still air; it is not like the airway in a mine where you have an appreciable current which will deflect the flame of a candle very distinctly, which you can feel very dis-

tinctly. In that case I should say that a temperature of 78° would be very warm, but you would not be very uncomfortable in it.

3127. The weavers complain that even from our present system of ventilation the air moves too rapidly for them, they complain of draughts?—Yes, but I do not think they would complain of draughts if you had them at a temperature of 80°. With a temperature of, say, 65°, or not much more than 65°, they would certainly complain of draughts, one would complain of them one's self.

3128. (*Chairman.*) I think you take it that the schedule requires revision?—I think so, in the light of the fact that the effect of moist air on a man is absolutely different from its effect on cotton fibres. I think that is what it comes to. To cotton fibre it is the relative humidity that matters. To a man it is the relative humidity up to a certain point; but beyond that it is simply and absolutely the wet bulb temperature.

3129. May we ask you if you would suggest on what lines revision should take place; for instance, would you abolish this table, and produce something else?

3130. (*Professor Lorrain Smith.*) Before we leave this question, is not Mr. Scudder referring there to the likelihood of moisture being deposited on the clothes?—I think he had that, perhaps, in mind; but I think that is a minor point when the clothes are full of moisture from inside perspiration.

3131. I got the impression, from reading his evidence and hearing it that that was regarded as a very important point in framing the schedule. He is thinking of it, and making this comparison between a saturation of 88 per cent. at two different temperatures; the clothes would not get any wetter in one than in the other?—I think he is perfectly right in that respect.

3132. He says the wetting of the clothes is the cause of the chill, and that is the feeling the workers object to?—Yes.

3133. (*Chairman.*) That confirms what I thought he had in mind, that is, chill. (*Witness.*) But he did not take into consideration the moisture from perspiration.

3134. (*Professor Lorrain Smith.*) We, perhaps, ought to refer to his remarks later on.—I should like to say in this respect that the effects depend a great deal upon the time a person is in the warm air. If you just go for a short time—twenty minutes or so—into a room in which there is warm and moist air, you are not affected so much as if you had been in there for several hours. The reason for that is that if you have been in there for three hours your clothes have got gradually wet with perspiration, and they are much wetter than if you had been only for a short time there; so I think one must be careful in drawing inferences.

3135. The average spell is four hours, I think?

3136. (*Mr. Shackleton.*) Many of them are in the shed from six o'clock in the morning till half-past twelve o'clock; quite a number of them get their breakfasts there.

3137. (*Professor Lorrain Smith.*) I asked Mr. Scudder this question: "In drawing up the schedule was any attention paid to the limits possible for human beings to stand, say, the wet bulb temperature?" His answer was: "I do not think that came into our mind. I am afraid my original, which is destroyed, never covered the range of the present schedule. I have an idea that I never went above 85° dry and 79° wet. In interpreting his explanation of how the schedule was framed one must take this into account?—Yes, certainly.

3138. He cannot explain how the schedule got prolonged up to 100°?—I cannot throw any light upon that, either.

3139. (*Chairman.*) Might we go back to the question? My question was what you would recommend in regard to revision. I am sure you will put it much better in your own terms than anything I can suggest?—I should propose that 75° wet bulb be taken as a maximum; that is to say, that the schedule should stop at 75° wet bulb. Below that there should

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be always a difference of not less than 2° between the two thermometers. Make a simple rule of that kind, which is practically the present schedule, and that during the cooler part of the year the maximum wet bulb should be 70° . My reason for that is that in the cooler part of the year people wear more clothing, and that consequently when they go into a warm place they are more liable to feel the heat and get wet from perspiration. 70° wet bulb is the temperature which the Home Office Factory Ventilation Committee specified as the maximum which should usually be allowed in a factory; but I think, considering the special conditions in Lancashire weaving sheds, and limiting the 75° to summer weather, the warmer part of the year, there would be no objection to going to 75° .

3140. Of course you are bearing in mind no doubt the requirements for manufacturing purposes?—Yes, I am bearing that in mind, and also the conditions. I should never propose to put the limit of 75° for work in mines where the men can take off their clothes or to work in spinning sheds where I gather there are only men employed, and I suppose they can wear as little clothing as they like. In spinning work where spinning is carried on and there are only a few men employed at a high temperature, I think that is a different case, because as I understand the men can take off as many clothes as they like.

3141. (*Mr. Shackleton.*) Spinners work in overalls as a rule?—I think that is a different case from a weaving shed where you have women employed and they have to wear their ordinary clothes more or less; and that is quite a different case from a mine where the men work stark naked. They are working stark naked below Salford now at the Pendleton Colliery, without a thing on, at wet bulb temperatures up to 82° and 83° .

3142. (*Chairman.*) That is what you would suggest?—Yes. Of course I have not made a very special study of this question, but I have borne in mind the difficulties in maintaining such a temperature, so far as those difficulties are known to me.

3143. I think you deal with that later on?—Yes.

3144. (*Mr. Cross.*) You say you would propose that 75° wet bulb be taken as the maximum and you would take 2° between the thermometers. What will the dry bulb be in your estimation?—It might be anything; but if it were very high the air would be too dry for spinning. If it were much over 80° I suppose the air would get gradually too dry; for weaving, I mean.

3145. (*Chairman.*) There is a passage on the third page at the top which perhaps I have failed quite to understand. "I am not aware of any serious injury to health from working in warm or moist air, provided that any considerable rise of body temperature is avoided." I rather gathered that it necessarily followed that injury to health would follow from working in warm or moist air?—I should say it was usually a minor injury to health. It is great discomfort. Various minor ailments result from it. It is what you call an unhealthy trade, but the effects are not usually very serious, or, so far as I have been able to ascertain, sufficient to keep people from doing that sort of work. For instance, in this mine I was referring to they have lost lately I believe about half their men, simply because other mines in the neighbourhood have been opened up, and the men will not go into the hot place; they do not like it.

3146. In the first place we may take it if serious?—It ought, perhaps, to be underlined.

3147. We have to consider bodily discomfort?—Bodily discomfort I think is a very important consideration.

3148. Do you think the workers would suffer bodily discomfort under those conditions?—I think certainly they must, judging from my own experience, suffer considerable bodily discomfort at temperatures of over about 75° wet bulb, and they would feel slack. I should have said it was very difficult to work at that sort of temperature; that it made work more difficult.

3149. Have you read, for instance, the report of Mr. Rogers, the cotton cloth factory inspector, in regard to alleged bodily discomfort suffered by the workers?—Is that a late report?

3150. It is a late report?—I have not seen it.

3151. Later on you come to the question of keeping the sheds cooler, and I think in substance the recommendation is that when you get to certain temperatures, instead of using steam, one of the many existing methods of humidifying by cold air carrying moisture from evaporation should be employed, and we may also say by atomizing the water?—That is a very good way of producing rapid evaporation.

3152. On very hot days where the temperature exceeds a certain point, would you recommend such a system?—Yes, it seems to me to be a rational way of doing it, particularly since on those hot days the air is as a rule very dry; I mean the relative humidity is low in the outside air. On the hot summer days, when you have a temperature of perhaps nearly 90° outside, the wet bulb is very much below that— 20° or so lower, and consequently the cooling effect produced by evaporation of water is very large indeed.

3153. You say, for instance, if the air outside is at a temperature of 90° , with a wet bulb thermometer at 70° , this air could be cooled to 70° by passing it through a saturating arrangement, the wet bulb temperature being now about 69° . In passing through the shed the air would be warmed several degrees by the heat from moving machinery. I should explain that we have given a considerable amount of attention to the various methods of cooling the sheds; also we have seen the many systems that exist of humidifying by vaporizing water; and I do not think we have yet found any method that would reduce the temperature by anything like the amount suggested here. We would like to know if you have in your mind any method by which this could be done?—My statements there are based on physical calculation as to the heat which disappears or becomes latent in the vaporization of water, and the amount which would evaporate with warm summer air passing through a saturator. Of course, a saturating arrangement may be very inefficient. I do not know what arrangements have been tested; and on many days, of course, the saturating arrangement would have hardly any effect, because the difference between the dry and wet bulb is small; but on the hot summer days it ought to have a very big effect.

3154. (*Mr. Roberts.*) What are those saturators—what system?—I remember, for instance, seeing a system in one shed in Lancashire in which the air entering the ventilators in the roof passed through a large screen of cocoanut fibre which was kept wet with water dropping down. I cannot remember where that shed was, but in that shed I remember the manager telling me that the air was much cooler in hot weather.

3155. (*Mr. Higson.*) Did he say how much cooler?—That I cannot say. The amount of cooling in the shed itself as distinguished from the air which is entering through the saturator would depend entirely on the amount of ventilation. If the ventilation was small the effect would be very small. If the ventilation was large the effect would approach to the difference in temperature produced by the saturator as the air passed through it.

3156. (*Mr. Roberts.*) Before we leave this point I should like to put one question to you, Dr. Haldane. Have I understood you correctly in thinking that you say that this table of humidity simply causes discomfort rather than injury to health?—I do not like to speak definitely on that point, because I have not studied the question specially in Lancashire. I have studied it in connection with mines, and I can answer for miners that on the whole they are not definitely injured in health by working in hot places; but, of course, they learn to work very little in hot places, to work very slowly or gently.

3157. You give somewhere in this epitome the relative humidity of Oxford?—Yes.

3158. I suppose you know that the relative humidity of Lancashire is higher than that of Oxford?—Yes, I gather that it is, and I should have gathered also that the temperature does not go so high in Lancashire as in Oxford.

3159. I do not think it does?—The temperature is steadier, but I should be rather astonished to find that

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the wet bulb temperature went to higher levels in Lancashire.

3160. You see we had no hourly records. I have not been able to find them, but we shall get them later I understand?—That is what I tried to get at when I was preparing my evidence.

3161. (Mr. Shackleton.) I notice you make special reference to the men being able to put off working a little when they feel rather hot?—In mines, yes—a great deal, I should say.

3162. I do not know whether you are accustomed to cur conditions in weaving sheds or not?—I know very well what the conditions are, and I gather that you cannot stop work.

3163. I wanted to be quite sure whether you knew that?—I had those conditions very distinctly in mind in drawing up my evidence. The whole of the machinery is going, and you have to look after three looms.

3164. Or four looms or more, some sixteen, some twenty?—You have to be always going and always on the *qui vive*.

3165. (Mr. Roberts.) I presume you are aware that it is absolutely necessary to have a certain percentage of relative humidity to work cotton yarn successfully?—Yes, heavily sized cotton.

3166. I wish to call your attention again to Mr. Frank Scudder's evidence which I can repeat from memory to this extent at any rate: he stated that the best percentage of relative humidity for successful working of cotton yarn was 88—Yes.

3167. We also had evidence from factory inspectors; in one case it was Mr. Rogers. He said that he did not think it was possible to weave successfully with below 71 per cent. Mr. Taylor, another factory inspector, stated that in his opinion it was necessary to get the most humidity that the Act would allow. We have had several weavers' secretaries before us giving evidence; and in one or two cases they stated that if artificial humidity was done away with they could not possibly work in certain of their mills. We have had manufacturers before us who in every instance have told us that nothing less than 75 per cent. would do in any sort of trade, and in some trades it was necessary to get up to practically the full 88 per cent. Now I want to call your attention to this: that if we are bound down say not to go above 75° wet bulb in summer time, and say 80° dry bulb, we should then have about 77 per cent. of relative humidity; but of course if our dry bulb goes up, which it could easily do—we have had cases only last year where it went up to say 88°—if, then, we have to have 88° dry and 75° wet, we shall only have 49 per cent. of relative humidity?—Yes.

3168. How are we to weave under those conditions?—Do not let the temperature go up to 88° dry bulb.

3169. But supposing we cannot keep it down, what are we to do?—I think it certainly can be kept down with proper means.

3170. I wished to bring that forcibly before you: the effect that this might have upon our trade if this Committee were to lay down that that was to be the maximum?—I see the difficulty, of course, and the risk; but then I think we have got a very serious difficulty on the other side, and you must steer between them as well as you can—I mean the effect on the workers.

3171. That is discomfort, not in the health?—I think if a man's temperature for instance is beginning to rise in a shed he would certainly come out before the effects were serious. He is not like a soldier who goes on until he drops. A man will not drop at his ordinary work in that way. I should say that probably it does happen sometimes. I once heard of cases of fainting occurring, but I should think that was very exceptional.

3172. (Mr. Shackleton.) Mr. Roberts has asked a question bearing upon the effect of the humidity on the fibre of the yarn. I should like to ask you in connection with the same thing whether in your opinion the warmth of a shed would not have some effect in easing the yarn—probably it would require more moisture at 60° than it would at 80°, and the warmth in the shed itself would assist. I want to

know whether you have considered that side?—I am afraid I have not. I would not like to express any opinion upon that, because I really do not know.

3173. (Chairman.) Coming to the dry sheds, you, I imagine, visited a great many during your investigations on the ventilating Committee?—Yes.

3174. And you know that as a matter of fact weaving is carried on in sheds that are known as humid sheds and in others that are not humid sheds?—Yes.

3175. Do you know that in many instances the same goods are produced in both?—Yes, in sheds which do and do not come under the Cotton Cloth Factory Act.

3176. Yes, are you able to give us any information with regard to the actual amount of moisture that was found in the so-called non-humid sheds?—I am afraid I cannot give any definite figure; but my impression was that often at any rate in non-humidified sheds there was just as much moisture as in the humidified sheds.

3177. From what source would you say that moisture was obtained?—Largely from the bodies of the persons present there.

3178. And from respiration?—From respiration also. A great deal of moisture is given off from the body—at least three or four times as much moisture is given off as carbonic acid, reckoning the amounts per volume.

3179. Speaking generally, in what condition was the air of those dry sheds as measured by the CO² test?—I remember one which struck me particularly; a shed in which the roof was air tight, and was covered with water, which had an excellent effect in keeping the whole shed cool. In that shed there was very little ventilation, and the amount of carbonic acid I think rose to about something like 35 volumes per 10,000 before the end of the day; it rose steadily the whole day. The shed was moist; one could feel at once that the air was very moist and cool. It was a little stuffy, but not really very unpleasant. They told me it was a splendid weaving shed, and I quite believed it. I thought this plan of putting water in the roof seemed to be an extremely good one on the whole; but of course the Cotton Cloth Factory Act was entirely avoided by the plan of restricting the ventilation and making the place air-tight.

3180. Speaking generally of these non-humid sheds, do you consider that the air from a sanitary point of view was in a satisfactory condition or not?—I should say that on an average it was fairly good; but in many sheds it was not good; it was not up to a reasonable standard.

3181. I think your Committee made a general recommendation, which included those sheds, that the standard should be raised from nine parts in 10,000 to 12 parts in 10,000?—Yes, the Committee made a general recommendation that that should be a standard applicable to all factories except in very exceptional conditions, and that humidified sheds should not be excepted. We did not see any special reason for making an exception in the case of humidified sheds and demanding a higher standard.

3182. Do you consider now that without injury to health the standard of ventilation could be raised in humid sheds?—Yes, I consider it might be, at any rate in the winter months. In the summer months I do not think you could keep the temperature within reasonable limits without fully the present amount of ventilation, perhaps more.

3183. I am not saying, of course, that it is to be recommended, or that it has yet been seriously considered, but it is a thing that must be considered; it would certainly facilitate the doing away with artificial humidity were the standard of ventilation slightly raised?—Yes.

3184. But you will perhaps remember that your recommendation to raise the standard was very warmly opposed by certain representative bodies of medical men?—It was.

3185. Do you happen to remember who they were?—I think the Incorporated Society of Medical Officers of Health was one body, and I rather think that the Society of Certifying Surgeons was another body.

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3186. Is it within your memory that it was suggested that the factory operatives were treated worse in that respect than criminals in gaols or soldiers in barracks?—I think there was something of the sort in this paper; I am afraid I did not pay much attention to it, because I came to the conclusion that the people who drew it up knew very little about ventilation.

3187. In the light of further experience—I mean supposing it should enter the minds of this Committee to suggest some alteration in the standard of ventilation, we must anticipate the same criticism that you met with before, and could you suggest to us scientists, physicists, or medical men or others who would support the idea that the standard of ventilation might be altered, that is I mean raised?—I should like to point out that at present there is no standard of ventilation whatsoever for factories generally. This standard was proposed with the view of improving the present conditions.

3188. I mean the one that is established. The point to bear in mind is whether people are going to suffer or whether they are not going to suffer. There is no object in putting inconveniences in the way of a trade unless for the benefit of somebody—the benefit of the worker.

3189. (*Mr. Roberts.*) Never mind the employer. (*Witness.*) I think you know we should all be the better for more fresh air. I do not want to suggest that we should not; but that standard was proposed as a practicable standard, considering the difficulties of all sorts, draughts and so on with any ventilation.

3190. (*Mr. Shackleton.*) Without any reference to artificial humidity?—Without any reference to artificial humidity. In my view about the artificial humidity, the recommendation of the 9 volumes as a standard has done a great deal of good indirectly by keeping down the wet bulb temperature.

3191. (*Mr. Roberts.*) You say in your epitome of evidence that this standard permits of the addition of a very appreciable amount of moisture to the air by natural and unavoidable means, and were it adopted no artificial moisture might be needed for weaving?—In some cases.

3192. Then you say: “I think, however, that light steaming with pure steam or light humidification by evaporation of water to the extent of, say, 65 per cent. of humidity might also be permitted”?—65 per cent.; I only mentioned that as a rough guess; it must be whatever is necessary.

3193. What I want to point out to you is this: that it occurs to me that if the legal standard for non-humid sheds was fixed at 12 volumes we should then be compelled to humidify for the purpose of weaving?—In some sheds you would.

3194. In many sheds?—But I should point out that there are probably hundreds of sheds working in which the standard of 12 volumes is at the present time maintained; and so far as I know there is no serious difficulty in weaving.

3195. That leads to another point, that is the style of cloth woven?—Yes, quite so.

3195a. There was another point. You said a little while ago that in many of these dry sheds you thought there was the same amount of relative humidity as you have found in humid sheds?—Yes.

3196. So that they are getting it somehow?—Yes; this standard would knock out that particular shed I referred to. They would have then to use some kind of artificial humidifier in that shed.

3197. Amongst the hundreds you referred to there may be a number of that sort?—A large number are working with very good ventilation in the shed, and there is a certain amount of natural humidity from the evaporation in the shed, and the work seems to go on all right.

3198. (*Mr. Cross.*) You speak about light steaming with pure steam. Do we understand that that implies the use of pure water?—Yes, that means the use of pure water.

3199. Not the use of canal or lodge water?—No; that is horrible.

3200. (*Mr. Shackleton.*) On that point you think that the use of canal water or dirty river water directly for the purpose of sending in steam is really a serious grievance?—I think that any water that has an unpleasant smell is very objectionable.

3201. The effect of that is really felt in the smell in the shed from the steam?—I think sometimes the smell has been in the past, at any rate, due to that fact. I think that is guarded against now.

(*Mr. Shackleton.*) It should be.

3202. (*Mr. Cross.*) That was guarded against by the use of pure water boilers?—Yes.

3203. Has there been any order from the Home Office, do you know, or any understanding that the use of pure water was not necessarily meant to be town's water; that canal water was considered to be sufficiently good for steaming purposes?—It all depends on the canal water. If you took it from one of the canals in the country it would be excellent; but if you took it from a canal in Lancashire, I am not quite sure what it would be like.

3204. (*Mr. Higson.*) I think the wording of the recommendation of the Home Office was that it should be pure water satisfactory to the inspector. It did not specify the source.—It might be quite unfit for drinking and yet quite fit for this purpose. For instance, water containing too large a proportion of salt or mineral constituents would be quite good for steaming.

3205. With reference to raising the quantity of CO² possibly to 12 volumes, do you think that any considerable amount of ventilation could be maintained, and that an atmospheric condition suitable for weaving could be maintained without exceeding 12 volumes of CO²?—Certainly, there are many sheds working with less than that amount of CO² in the air.

3206. Without artificial humidity?—Yes, without artificial humidity.

(*Mr. Higson.*) We have not been able to find it.

3207. (*Mr. Shackleton.*) There is a table here at page 54 of your work where there are eleven of them with all under ten volumes and no artificial humidity?—Yes.

3208. The question was on the CO², and whether work could be produced with less than twelve volumes without artificial humidity.

3209. (*Mr. Higson.*) With a suitably ventilated shed?—I am afraid that would not do for certain kinds of cloth.

3210. (*Mr. Shackleton.*) You see when you get to Blackburn you find the conditions much worse. There are several towns given where the CO² is less than 12?—Yes.

3211. There are eleven cases in one sheet; there are others worse in Blackburn?

3212. (*Chairman.*) I would like to go back to this question of purity of water. In the statutory rules for dangerous and unhealthy industries applicable to the processes of spinning and weaving flax and tow, Rule 6 is this, “No water shall be used for producing humidity in the air or in wet spinning troughs, which is liable to cause injury to the health of the persons employed, or to yield effluvia, and for the purpose of this regulation any water which absorbs from acid solution of permanganate of potash in four hours at 60° more than 0.5 grain of oxygen per gallon of water shall be deemed to be liable to cause injury to the health of the persons employed.” Perhaps it might be difficult to say right off whether you would approve of that rule, and if not, might we ask if you would consider it and give us your opinion?—I think that water which was dangerous to handle, undesirable to get about, that is to say, infected water, might escape that test—water infected with typhoid bacillus. That water includes water which has not been boiled, does it not? The water in wet spinning troughs need not necessarily have been boiled.

3213. That would not apply to what is before us now; there are no troughs?—No, it would not apply here.

3214. The water here would be necessarily boiled?—I should like to point out about that rule that I myself should have preferred the simple rule, that no

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water which gives off any unpleasant smell should be used.

3215. The difficulty about that is that the sense of smell of an inspector is perhaps much keener than the sense of smell of the employer, or the sense of smell of the operative may be keener than that of the employer?—I can imagine—I think I could concoct some water which would pass this test which would have a most abominable smell.

3216. It would take a great deal of doing, would not it?—I do not think so. I think I could do it straight away. Some strong smelling compounds are very resistant to permanganate of potash.

3217. Can you suggest any other test than the sense of smell?—That is a test I should have suggested myself as being on the whole least unsatisfactory, but possibly this permanganate test will work out well in practice—I do not know—I am not sufficiently acquainted with it.

3218. (*Professor Lorrain Smith.*) You did not quite answer the Chairman's question about giving evidence on the recommendation of 12 parts per 10,000 of CO²?—I should think you could get evidence upon that point from almost any physiologist who had gone into the question at all. There are a great many people who express an opinion upon this point very confidently who have never made any real personal observations on the subject.

3219. We should apply, you mean, to those who have investigated?—Many have expressed opinions who have simply passed on traditions.

The witness withdrew.

Dr. WILLIAM MOIR, called and examined.

3224. (*Chairman.*) Will you please state your qualifications?—Master in Surgery, Bachelor of Medicine, Doctor of Medicine (Aberdeen), Diploma of Public Health (Cambridge).

3225. I think you are a medical practitioner in Blackburn and Darwen?—Yes.

3226. I have your written epitome here, and I propose just to ask you questions so that we can get it in our evidence, and that will give an opportunity to members of the Committee to ask any questions that may arise. You state that you have not met with a disease which one could call peculiar to or prevalent among weavers as an industrial type?—That is so.

3227. You say that the industry of weaving on the other hand could not be described as an occupation surrounded by the best hygienic advantages, still the operatives enjoy better health under the present limitations of humidity and CO² than several other trades in which more rigid legislation has been enforced?—Yes.

3228. Now you refer, I take it, to the standard of ventilation laid down under the Cotton Cloth Factory Act of nine parts of CO² in 10,000?—Yes, and as to the amount of air supplied, 600 cubic feet per hour I think is laid down by the Act.

3229. That was, I think, superseded when the standard of ventilation of nine parts of CO² was laid down?—Yes.

3230. That was done away with. Have you had opportunities of considering non-humid sheds as well as humid sheds?—There is only one non-humid shed that I am aware of in Darwen—I speak under correction, but I believe there is only one non-humid shed in Darwen.

3231. Have you had an opportunity of visiting any of those sheds, either humid or non-humid?—Yes, I have. I have visited six or seven cotton mills.

3232. Were they all humid sheds?—One non-humid and the others were all humid sheds.

3233. You visited a non-humid shed?—Yes.

3234. Did you form any opinion as to the purity of the atmosphere in the different sheds?—I should prefer a humid shed to the non-humid one on account of the temperature being more equable.

3220. We should apply to those who have done investigations on the subject?—Yes, but there are not very many I am afraid in this country.

3221. Another question has occurred to me. Have you any recommendations to make as to the observations we should either do or get done as a Committee?—I should certainly suggest making a number of experiments in some shed in the hot weather, in summer; in some typical shed; a shed that has not got either a specially good or a specially bad roof; a fairly average shed; and that you should observe by what means the temperature can be best kept down, and what it is really practicable to do when proper appliances are used for the purpose, when there is proper ventilation and means of humidification which will cool the air as it comes in. All my recommendations are really to a considerable extent based on calculations. I have gone into the matter as carefully as I could without making careful observations in actual weaving sheds; for instance, I did not know the amount of heat produced by the machinery in a weaving shed; how much horse-power runs down in a weaving shed, and therefore how much heat is produced by the machinery—I did not know that accurately.

3222. (*Mr. Roberts.*) You may take three looms per indicated horse-power in round figures?—That is exactly the figure I took at a rough guess.

3223. That is near enough for practical purposes?—In that case the machinery would produce about five times as much heat as the men in the shed, or something like that.

3235. In the humid shed?—Yes.

3236. Did you take any readings in the different sheds—I mean to say the humid sheds and non-humid shed?—I did not take any readings in the non-humid shed, but I made several observations with regard to temperature, particularly in humid sheds.

3237. At what time of the year?—Last week.

3238. And approximately what was the temperature?—It has been asserted, Sir Hamilton, by several that one's body temperature rises with the surrounding atmosphere if it is fairly high. I personally doubted this fact, and made observations upon myself as to the effect on the body temperature, and took the highest possible temperature that I could get, namely, in a spinning room; and for easy reference these are the notes which I took at the time. If they are not sufficiently clear, please tell me.

3239. I should like to point out that our reference is as to weaving sheds and not to spinning rooms; and the condition of things is very different in the spinning room; you have naturally a high temperature from the revolution of the spindles, and also you have no standard of ventilation and no moisture. Was it a wet spinning room, an artificially humidified spinning room?—No; it was not. But the dry and wet bulb readings were taken in the spinning room.

3240. What were the temperatures?—In one room the wet bulb was 75°, the dry bulb was 92°.

3241. Which would give a relative humidity of?—41 per cent.; and in another room the dry bulb was at 95°, the wet bulb 77°, giving a relative humidity figure of 39 per cent.

3242. That is in a spinning room?—Yes. There are two weaving sheds here also where the wet bulb was 64·5°, the dry bulb 67°.

3243. That is in a weaving shed?—Yes.

3244. With a relative humidity?—85·5. The dry bulb was 65°, the wet bulb 62·5°, the relative humidity 85·5 per cent. In another the dry bulb was 68·5°, the wet bulb 65°, the relative humidity 80·5 per cent.

3245. The question of the readings in the spinning room, of course, is no doubt interesting from many points of view, but I am afraid it does not help us

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very much. What we are considering is a statement, and a generally believed statement amongst the operatives, that the artificial humidity at high temperatures produces discomfort and ill-health. Can you express any opinions upon that point?—I have never seen any evil effects from it in practice in Darwen during the last fifteen years or in Blackburn.

3246. You have seen no evil effect from the introduction of artificial humidity?—That is so, considering its present limitations.

3247. Have you seen any evil effect from a large amount of carbonic acid in places where there is no standard of ventilation?—Not in weaving sheds.

3248. You say something about, and you have evidently had some information on the question of a ballot of the workers, and you refer to a vote that was taken?—Yes.

3249. Would you like to tell the Committee any opinion you have formed with regard to the value of that expression of opinion?—I have asked many of the operatives with whom I have come in contact day by day questions upon it, and I did so during the time this vote was being taken. Having taken an interest in the subject of public health among industries, of which the Lancashire cotton industry constitutes a very important part, I put many questions to these people as to the discomfort, if any, that arose from humidification of sheds, and asked them what they knew about relative humidity; and without exception I never met an operative who could tell me anything about relative humidity—not a solitary one.

3250. Perhaps they might not understand you if you asked them about relative humidity, but if you asked them whether they suffered discomfort from, we will say, putting on something damp from moisture in the atmosphere, what do you think their answer would have been to that?—I have heard two or three say that the atmosphere was always wet in weaving sheds, and knowing of the limitations of the Act, that one cannot exceed 88 per cent. of relative humidity, it is physically an impossibility that the condition of the weaving shed could have been wet; and again some of the enthusiasts say that it tends to promote rheumatism and bronchitis and other ailments. Personally, I think that rheumatism—I do not mean acute rheumatic fever, but chronic rheumatism is much more likely to be benefited by a high relative humidity figure than otherwise; and bronchial cases benefit very considerably by going into a humid shed, more than if it were a dry one. Many of the arguments that have been put forward I think are fallacious, from my view of the subject at any rate.

3251. You refer to the compulsory use of a cotton overall changed twice a week; you say you think that it would add to the comfort and cleanliness of all operatives in a weaving shed?—Yes. I think many of the weavers are very untidy—putting it very mildly indeed. We all know that soap and water are cheap commodities, and that the operatives wear garments that are very filthy indeed; and I think that an overall that should be changed clean twice a week would not only add to their comfort but take away a great deal of the organic effluvia that would arise from these weaving sheds.

3252. Personal cleanliness you recommend, I take it?—Certainly.

3253. You refer to the relative humidity for our country given by De Chaumont Parkes Notter and Kenwood?—Yes.

3254. As 75 per cent. relative humidity?—Yes.

3255. And your own investigations do not quite support that for this district I think?—Not for this district. It is higher.

3256. You have made investigations and you fix it at what?—86 per cent. for those months, May to October, 1906.

3257. You say the relative humidity varies enormously from hour to hour?—Yes, I have found it so.

3258. And you take the relative humidity figures for the three hottest days from your own records to show how it varied for the outside air?—Yes.

3259. The dates are August 31st, September 1st and September 2nd, 1906?—Yes.

3260. The relative humidity at 8.45 a.m. being for the first day 98 per cent., the second day 96, the third day 94?—Yes, that is so.

3261. That is at 8.45. At 2.30 p.m. it was 49, 50, and 45?—Yes.

3262. At 6.30 to 6.45 p.m. it was 73, 70, and 68, and you say that the feel of the atmosphere was more pleasant in the morning with such a high relative humidity than at 2.30 with a low one?—Yes.

3263. And that that is due to the body not behaving like a thermometer to the surrounding atmosphere?—That is so.

3264. (*Professor Lorrain Smith.*) How detailed were your observations to give you the mean of 86 per cent.; how did you arrive at the observations which give you this mean of 86 per cent. of relative humidity in the outside air?—They were taken twice daily; they were all added together and divided by the number of observations.

3265. And what variations were there?—The lowest was in the very hot days; I think the first or second of September, to a condition of practically saturation, 98 per cent.

3266. Fifty per cent. was the lowest?—There is one of 45.

3267. If the outside air at summer temperature has 86 per cent. of humidity it itself is in an ideal condition for weaving, and there is no need for humidity?—It requires some qualification. A high relative humidity figure does not convey anything to the mind of anyone unless the temperature is expressed.

3268. Summer temperatures in which you would not want to heat the place beyond summer temperatures—you might pour in this air to the shed at any rate you liked, and you would still have ideal conditions for working?—You may have a relative temperature of 76 and —

3269. No, take summer temperature—a mean of 86 would be an ideal condition for weaving. Why any artificial humidity at all if this is the average?—The average, I take it from my own records, is certainly over 75, when other than summer months are included.

3270. Over 75 per cent.?—Yes.

3271. (*Mr. Shackleton.*) In the first sheet of your evidence you have this expression which I want you to explain in your own language: "What will wet yarn will wet a man." That is a common expression, as you say?—I believe it is; I have heard it several times.

3272. You say it is not true?—Yes.

3273. Supposing we are speaking of cotton weaving, the weavers have an idea that this humidity to the extent of 88 per cent. is put in for the purpose of damping the warp and making it weave. You tell them at the same time that it does not damp their clothing. Will you explain in your own way how a cotton operative would be satisfied of that—some form of words that would convey to him that it had not that effect?—I should proceed to explain to him that the atmosphere had a peculiar property of carrying moisture. I should point out to him that at 32° a cubic foot was capable of carrying—shall I use the expression on its back—two grains roughly of aqueous vapour, and then point out to him that at a temperature of 100° it was capable of carrying 19.8, for the sake of round figures 20 grains, that would represent a difference in 68° F. (between 32° F. and 100° F.) 1,000 per cent. in its power of carrying moisture. So that as the atmosphere increases in temperature its capacity for carrying moisture increases along with it. I think he would be able to understand that quite clearly.

3274. I am afraid I do not. I was just going to ask you whether in the term "man" you mean here the man himself or his clothing?—I shall come to that presently if you will allow me to lead you up to that particular point. May I take it then, Mr. Shackleton, that you can follow me in that one particular, that a cubic foot of air, say at 32°, is capable of carrying two grains of moisture. At 100° it is capable of carrying 20 grains, representing a difference of 1,000 per cent. You know that our body

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temperature in health is 98.4° or 98.6°. You know that one's clothing attached to one's body will become heated up according to the temperature of our body. The clothing tends naturally to follow the temperature of one's body. Then, having a clear conception of that, we shall suppose now that the temperature of the wall is probably 20° different from that of the centre of the room, or even more than that. Supposing that you had a relative humidity figure of 88 per cent., that part of the atmosphere coming in contact with the walls would become cooled down, and no longer capable of carrying its load of moisture, some of which would become deposited on the wall in a somewhat similar way as it would become deposited on any cold surface like iron in the mill that had a very much colder temperature than it had itself. You take then the yarn which we shall say has a temperature less than the atmosphere itself, and you take one's clothing which has a higher temperature, a temperature very much nearer that of one's body; and inasmuch as the atmosphere possesses that peculiar property that it will not deposit its dew upon any surface unless it is actually colder than itself, then I think you will be able to understand that that which will wet yarn does not necessarily wet a man. The temperature probably of yarn is about 60°; a man's temperature is 98°, and since it will deposit on contact with anything colder than itself, so it will take up more when the surface is warmer than it comes in contact with.

3275. But if a man's coat or a woman's shawl is hung on the wall, apart altogether from the body, will it have the same effect?—It will wet it just as it will wet yarn

3276. So it will wet clothing that is hung up on a pillar or on a wall, or anywhere other than on the body?—Yes.

3277. It will wet clothing in that sense?—Most assuredly.

3278. Another question. In the last paragraph but one of your statement there is this: "The feel of the atmosphere was much more pleasant in the morning"?—Yes.

3279. "With such a high relative humidity figure than at 2.30 with such a low one." I take it that that is the experience of everybody. The first thing in the morning is the best time to take a bicycle ride; you will go longer?—It might be in the evening.

3280. Take evening, when the sun has gone down. But you would not say that a relative humidity of 98, 96 per cent. and 94 per cent. at the middle of the day with the temperature at 80°, 85°, or 90° would be pleasant, would you?—No, I should not care for it.

3281. That the relative humidity brings about the pleasantness rather gives a wrong impression, does not it; is not it rather that it is the relative humidity on the dry bulb being considerably down?—That depends entirely where you take it. Practically quite near to the surface of the ground on any evening you will get a relative humidity of 90, yet 6 ft. above the ground it is exceedingly pleasant. You cannot have a vertical temperature gradient so long as we have convection.

3282. You would not say that these three relative humidities that you give here at the middle of the day would be at all pleasant?—No; I only cite that to show how relative humidity does vary, even in our climate, almost from hour to hour.

3283. Take the climate of Egypt, or of India, or of the Southern States of America—dry climates—a low percentage of humidity is much more pleasant for them?—Take the very striking example of the Rockies. On one side they are beastly; on the other side they are delightful.

3284. What is the difference?—The one is a nice climate.

3285. Dry?—Fairly dry; and the other one is very cold and wet.

(Mr. Shackleton.) That is what I wanted to get at.

3286. (Mr. Cross.) I am interested in one thing you said; but I might not have understood you. In some forms of rheumatism you say that a humidified shed would be good for anyone suffering from that?—Yes.

3287. Did I understand you rightly?—A moderate humidity, certainly.

3288. (Mr. Shackleton.) But up to 88 per cent?—Without fear of injury.

3289. (Mr. Cross.) We have always been given to understand—and perhaps that accounts for our being somewhat prejudiced—that if we get rheumatism we have been getting damp, getting wet through, or have lived or worked in a very damp place—we generally say that that has been the cause of it, and a doctor gave that reason not long ago with regard to a lad of mine. It seems to me, being a weaver, a strange thing to be told that, having a certain form of rheumatism, it would do me no harm to be in a humid atmosphere. We have always believed different to that, and been told different?—Acute rheumatic fever and chronic rheumatism are two totally different diseases. Unfortunately, the public mind does not seem yet to be quite educated up to understanding that there is a distinct difference between them, as different as chalk is from cheese.

3290. (Mr. Shackleton.) It is not always advisable to send a rheumatic patient away to the sunny south, then?—That is because you have a higher temperature—just for the very reason that I explained: your relative humidity is not to be accepted as the condition of things without a temperature. The sunny south, of course, affords a very much higher temperature; indeed, you have got a climate; but as to this northern part here, many years ago the impression made on an American (who took rather an interest in climatology when he came over here) was such that he said we had no climate here, we had only samples.

3291. (Mr. Cross.) When taking these observations which you have given in your reference, could you say how long you were inside the mill in each case?—In the spinning room, where I made these observations, I was in it for 20 minutes. It was a very hot place, up to 92° or 95°, I forget which, where my own body temperature rose 0.4, but very soon reached the normal condition of things again when I left it. Perhaps you would like to see these figures. (*Memoranda handed in.*)

3292. (Mr. Shackleton.) That was in a spinning room?—That was in a spinning room. There is undoubtedly a physiological rise of temperature if a man leaves an outside temperature, say about 45°, 50°, or 60°, and goes into a spinning room with a difference of about 30°. The delightful balance in Nature between the cooling effect of evaporation from the surface of the body and the heat-governing functions seems—for a short time, at any rate—to be disturbed; but the tendency is always for it to return again to its normal condition. I think that has been borne out recently by several who have inquired into this subject, among others, Professor Haldane. Many years ago I read a report of his in the "Journal of Hygiene," in which he pointed out that one's temperature rose if one remained in a hot atmosphere for any length of time, and that it did create a considerable amount of bodily discomfort. Those experiments were not only conducted in a laboratory, but also in the Dolcoath mines, down south. While having a high appreciation of Dr. Haldane's qualities and abilities, it seemed to strike me that he had made rather an error in that he did not take the temperature of the people in the place instead of his own. I feel sure if he had done so he would not have found a rise of temperature. In all these experiments I have made, and in the experiments that I believe a surgeon of repute made in India—groups of experiments—it was found that the temperature was subnormal. I have always made a practice of taking one's temperature, and during the last 15 or 16 years, at a moderate computation, I have taken 160,000 temperatures or over; and in health one's temperature is either normal or subnormal; and if you have a very rapid change from a moderate temperature to a hot one you have a physiological rise; but that rise does not remain for any length of time; it is down directly. A striking proof of that I had only last week, while making these records. A man had been off work through an accident, and he went into a spinning mill to see whether he was really able to follow his ordinary employment. While there the manager of the mill asked me if I would look at his arm. He was

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sent for from the spinning room into the office. I examined his arm and took his temperature. His temperature was practically 99°. I asked him how long he had been in the spinning room, and how long he had been absent from it, and other questions, and it appeared that he had not worked from November, and he had gone in that particular day just to try for a couple of hours. I asked him to come and see me in the evening. He did so. I found that the man had a slightly subnormal temperature about two hours after I had seen him.

3293. (*Mr. Cross.*) How long were you in the weaving shed?—Not longer than necessary to take these temperatures.

3294. Supposing you were in three or four hours, and you had 90° of heat, would the bodily discomfort from your point of view be very great, taking twenty minutes inside a mill as against working four hours in a mill at, if you like, a temperature of 88° dry bulb?—The spinners that I saw were quite comfortable.

(*Mr. Shackleton.*) But they are in a dry atmosphere.

(*Mr. Cross.*) I am speaking of a humid shed.

3295. (*Mr. Shackleton.*) Mr. Cross is trying to bring out what the effect would be. Did you make any test in a humid atmosphere at 88°?—Yes.

3296. Your ideas of bodily discomfort applies to a spinning room only?—Yes.

(*Mr. Shackleton.*) That makes all the difference.

3297. (*Mr. Roberts.*) I think, Dr. Moir, you have taken some temperatures of the weavers?—I have.

3298. That was in a relative humidity of over 80°?—Yes.

3299. Do you mind reading them out—was there any effect on the body temperature over normal?—Practically none. I need not give you the names of them, but I will read their temperatures downwards—97°, 97·2°.

3300. Between what do they vary—97° to what?—They are all sub-normal, every one of them, except one, a rather sickly-looking woman, who had a temperature of 98·8°.

3301. (*Professor Lorrain Smith.*) How did you take the temperature?—Mouth temperature.

3302. (*Mr. Shackleton.*) In none of those did it exceed 68° dry?—68·5° dry.

3303. (*Mr. Cross.*) With the temperature normal, it does not follow that a person would not be in a state of bodily discomfort. Supposing the temperature were normal—I mean in a shed in the summer-time, with 88° of heat, or 86°, if you like?—You mean the dry?

3304. Yes, dry 88°. I put it that the bodily discomfort of people is great when steam is being poured in at the same time.

(*Mr. Shackleton.*) That is 88 per cent. of humidity.

3305. (*Mr. Cross.*) It is one of the greatest complaints in the summer-time. You might go into a mill in the summer-time for, say, perhaps, 15 or 20 minutes, and take an observation, but that is rather different to working continuously in it, having muscular exercise or work?—I should say that the discomfort should be mine and not the weavers, I not being accustomed to it.

3306. (*Mr. Roberts.*) You infer that these people by regularly working at these temperatures and in this relative humidity, get accustomed to it, and do not feel any particular discomfort?—No, just as you may regard the whole of the nations of the world as an expression of climate and temperature, which they really are.

3307. (*Mr. Cross.*) You are acclimatised?

3308. (*Mr. Roberts.*) Up to now the weavers have not been acclimatised, if their objection is anything to go by. You say the different nations of the world get acclimatised?—Yes.

3308a. (*Mr. Cross.*) Our people have not got acclimatised yet to what they consider to be an atmosphere of discomfort. At 88° of heat in a humid shed you say you suffer more as an outsider than they would inside with four hours' muscular exercise?—Yes, because I went from an atmosphere quite different in character, in point of temperature, outside to the inside; it was that sudden change that caused the bodily discomfort to myself, if I may put it in that way.

3309. (*Chairman.*) We would like to have these figures: we will not make use of the names; we propose to use the figures only?—You may have them, but should like them returned when you have finished with them.

The witness withdrew.

Mr. FREDERICK SCARISBRICK, called and examined.

3310. (*Chairman.*) I think you are president of the Blackburn and District Managers' Mutual Association?—I was in 1906 and 1907.

3311. Do you hold any appointment of that sort at present?—I am simply on the committee at present.

3312. Have you charge of a mill?—I have charge of three mills, James Halliwell, George-street, and Townsfield Mills, Darwen.

3313. I think you have given a good deal of attention to the question of humidifying in weaving sheds?—I have.

3314. You have delivered a lecture—this was given in the form of a lecture and subsequently published?—It was—to the Blackburn Managers' Association.

3315. You have a lecture to the Blackburn Managers' Association—when was that?—The date is here—27th April, 1907.

3316. That lecture was printed and published in this form, I think?—That is so.

3317. May we take it that generally speaking the views expressed here are the views you hold with regard to the question before us?—I have seen no reason to alter my opinions yet with regard to the matter in that book.

3318. You have probably heard that a ballot of the weavers through certain districts of Lancashire was taken?—Yes.

3319. With a view to ascertaining whether the weavers themselves considered that they suffered bodily discomfort or if their health suffered?—I have, and the result of that ballot is given on page 66 in the book; and the result of that ballot was one reason that induced me to go on with this work, to put what I considered were the facts of the case before both the operatives and the employers.

3320. The results as you say are given?—On page 66.

3321. Against steaming of course it is apparent there was a very overwhelming vote?—That is so.

3322. In the face of that, do you consider that the workers do not suffer bodily discomfort?—I do, taking the conditions all round. There may be exceptional days in the summer time which might need a little alteration.

3323. You think that speaking generally they do not suffer bodily discomfort?—I do think so.

3324. In consequence of the introduction of artificial humidity?—No.

3325. Do you think that they suffer in health in any way?—Personally, I do not think they suffer in health—not from what happens in the weaving sheds. I will not say that there is not a kind of carelessness at times that is prevalent in nearly all trades where people work at rather a high temperature in not

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taking sufficient care to clothe themselves to prevent catching chills after leaving work.

3326. Of course it is a very overwhelming vote, and we have to remember that where there is no artificial humidity the weaving conditions are generally recognised to be worse, and the wages would be smaller—is that so?—Yes, if there is no artificial humidity there is no doubt about it the yarn will not be as strong and the weaving conditions will be worse—that is, given the same amount of air movement in those sheds as in the sheds where humidity exists.

3327. You may not be able to give a definite opinion, but you will probably have formed some opinion as to why the operatives should by such an overwhelming majority say they suffer bodily discomfort?—Personally, I do not say that they suffer bodily discomfort; they only give a vote upon it, and naturally they would follow the lead of the leaders.

3328. What interest would the leaders have in influencing them in that?—In different districts there are certain opinions about this, certainly in Burnley for instance there is a great amount of prejudice against steaming. I think the agitation has come from the Burnley district. I may be wrong.

3329. You put it down to prejudice?—I do.

3330. You know of course that a great deal of weaving is done in what are called dry sheds?—Yes.

3331. In some I believe it is asserted that the output is quite as good?—In dry sheds?

3332. Yes?—That would depend upon the air movement. If you have a shed where the air movement is small through having little or no ventilation the probabilities are that you could retain a sufficient amount of moisture to weave fairly comfortably, only under very exceptional weather; but if the air movement is sufficient to produce a good standard of ventilation the weaving conditions would be worse.

3333. In the dry sheds?—In the dry sheds.

3334. We have asked many witnesses how to account for the fact that work of a similar character is done in dry sheds and in humid sheds, also we put it to them that the abolition of artificial humidity might mean a reduction of wages to them, inasmuch as their output would not be as great. A very large number of witnesses have replied that the wages would not be reduced if the employers used better stuff. Have you formed any opinion upon that question?—There is no doubt about it that if the counts and strength of material used were increased to a great extent there might not be a reduction.

3335. That would reduce the necessity for artificial humidity?—It would open out another question as to whether the price could be got for the cloth.

3336. I am not forgetting that. First of all I should like you to answer the question that I put, which I think was this: would the use of better material reduce the necessity for artificial humidity?—It does not matter how good the material is, the physical properties of cotton are such that if it is exposed to a humid atmosphere it will always be stronger and more pliable than if exposed to a dry one; and if both the operatives and the employers wish to conduct their work under the best conditions for producing the greatest output and the best quality of cloth, artificial humidity is necessary.

3337. We will suppose, for the sake of argument, that it were suggested that a better class of yarn should be used, what would be the commercial effect of that?—It would increase the price of cloth.

3338. Seriously?—Seriously.

3339. Can you form any estimate of the increased cost to the manufacturer?—It would be very difficult to say. It is one of those questions that you could not answer directly; there are too many factors to be taken into consideration.

3340. But is there a demand, and a ready demand for the cloth that is now manufactured with the so-called inferior material?—There is a very great demand for it; in fact the bulk of our export trade is for classes of goods of that description.

3341. Supposing the price were put up, should we be in danger of losing any of that trade?—I think we should be seriously in danger of it.

3342. Now in regard to the tables of humidity, you know those tables?—Yes.

3343. Would you suggest any alteration of those tables?—I would.

3344. What would you suggest?—I would suggest that there should be a maximum wet bulb temperature.

3345. That there be a maximum wet bulb temperature?—Independent of where the dry bulb temperature is.

3346. What would you suggest that maximum should be?—Well, it is difficult to state an exact figure; but from the experiments that I have conducted along with Dr. Howarth my bodily temperature does not keep on rising under 80° wet bulb for a three hours' spell; at the same time I wish to say that I have been trained to work under high temperatures. For seven years I was a tape sizer, and I might be able to stand a rather higher temperature than the ordinary operative; and I think that the health of the operatives is undoubtedly their greatest asset in life, and it should be taken into very serious consideration; and I would suggest that the maximum be not taken above 78°.

3347. You suggest 78° as the maximum to be allowed in humid cotton cloth factories?—I would.

3348. Can you conceive conditions such, for instance, as the very hottest days in summer where it would be impossible to keep as low as that?—There is no difficulty in keeping the wet bulb down; the difficulty is with the dry one. You can always keep the wet bulb down; that is one of the factors you can control.

3349. How would you do it?—Stop the humidifying apparatus.

3350. Then in other words it might be put that when the wet bulb reaches, as you suggest, 78°, it should be illegal to introduce any further humidity?—Those are my views exactly, though as I say the experiments show that I personally can stand 80°.

3351. With regard to humidifying you know, and we all know here, that there are various methods, there is what is described as the live steam method, there is the vapourising of water by various methods and carrying it into the shed—which system in your opinion is the better system, both for the health of the workers and for efficiency?—Well, a question of that description opens out a number of problems, and it opens out both the question of humidifying and the question of ventilation. In theory there is no doubt about it that the plenum system is ahead of the exhaust system.

3352. That is for ventilation?—That is for ventilation. In practice I think it will be found that sheds which are ventilated on the exhaust system will be found to have a lower dry and wet bulb temperature all the year round than the places that have the plenum system, and for this reason: that if you throw heated air into a shed or if you throw air into a shed you must keep that air at a higher temperature than the surrounding atmosphere, otherwise the weavers are subjected to a draught.

3353. You must keep it higher?—At a higher temperature.

3354. They would get a draught anyhow, but they would feel it more were it a cold draught?—I think there is a distinction between a draught and a current of air at the same temperature. I take a draught to be a movement of air at a lower temperature that you feel as it goes past, but if the air moving past you is practically at the same temperature as the rest of the air I should hardly call it a draught; I should term it a movement of air. I do not know whether the distinction is correct or not.

3355. There are various appliances which profess to be able either to heat or to cool the air according to the requirements of the season or even the day?—Yes.

3356. Now in the very hottest days of summer can you conceive that it would be desirable to try and bring down the interior temperature by the introduction of plenum ventilation carrying with it cold water?—I think every effort should be made that is

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practicable to keep down the temperature of the sheds in summer; at the same time I personally am opposed to cold water being used on the system of some of the appliances now on the market where an attempt is made to pulverise or atomise the water before it is vapourised.

3357. But you do think it desirable to keep down the temperature as much as is possible on those hot summer days?—Yes.

3358. Will you give us some practical suggestion? It is a question of considerable importance, and one must give a great deal of attention to it. Can you offer us any practical suggestion in the way of keeping down the temperature?—It is a very difficult thing to do. The only thing is evaporation of water as far as I can see; and even that when evaporated in the shed does not appear to bring the temperature down very much. The amount of heat that is radiated from the roof of a shed having such a large area and such a large amount of glass in is really responsible for raising the temperature. The difficulty of getting it down with just evaporating a little water inside is very great.

3359. What system of ventilation have you in your sheds?—The system that I have and the system that I believe in is the exhaust system; and I have a copy here of the tests which were made by one of the inspectors for CO₂, so that you can see exactly the results I am getting with the exhaust system.

3360. How do you humidify?—With the ordinary steam jet. The report reads: "The Analyst reports the following proportions of CO₂, 7·6 in No. 3 shed, and 5·8 in No. 1 shed at Townsfield, and 5·3 and 6·7 in No. 2 shed at George Street."

3361. At what time of the year?—This was sent 9/5/07. It would be taken about April or May.

3362. Have you any experience in non-humid sheds?—I have been in a few non-humid sheds, and I also got a few particulars of some dry sheds at the time that I was getting this other matter together.

3363. What do those particulars relate to?—Those particulars relate to the amount of CO₂ in the dry sheds, and they were all taken in Burnley.

3364. At what time of the year?—They were taken in February, 1907.

3365. Last year?—Yes, twelve months ago.

3366. Will you mind telling us what the results were?—The results varied from 12·9 to 33·3 in the dry sheds.

3367. (Professor Lorrain Smith.) What is the average?—I have not struck an average.

3368. (Chairman.) May we have this?—With pleasure. There are no names of millowners on there; I have them, but I was requested not to give them.

3369. (Mr. Shackleton.) It is one millowner?—Nine separate mills; and I should just like to state that four of those mills were originally humid sheds, and the apparatus for humidifying was still in the sheds; but owing to the objection of the operatives the employers had stopped it. Those sheds were formerly under nine of carbonic acid; and one of them has got up to 22·5.

3370. (Chairman.) You have put down the system of ventilation, and under that column we have Hart's, Roger Pye, Hart's and so on?—Yes.

3371. Does that mean that they are there, but not in use at this time?—They were not in use owing to the objection of the operatives.

3372. And the readings are 8·9, 12·9, 15·3, 16·2, 16·4, 16·9, 21·4, 22·57, and 33·37?—I have also given the dry and wet readings in the places that have a hygrometer hung up.

3373. I am going to ask you a question which is one that perhaps a medical man could answer better, but you may have formed some opinion of your own. In the humid cotton cloth factory with a standard of ventilation or in these sheds, comparing the two, in which of them would a worker be likely to enjoy the better health?—Unless our whole system of ventilation is on a wrong basis I should say in the shed where the CO₂ was nine or under and the humidity about the same as the outside atmosphere.

3374. That would be the favourable condition?—I should say so as far as my knowledge goes.

3375. (Mr. Shackleton.) Mr. Scarisbrick said that he had some humidity tables of these sheds as well where there was no artificial humidity? (Chairman.) Hygrometer readings?—The hygrometer readings, the grains of moisture in every cubic foot in the shed, and the excess of moisture over the outside atmosphere on the same day; the relative humidity is on as well.

3376. You have it in five cases?—In five cases. One of those sheds was a steaming shed, the only shed that was steaming in Burnley.

3377. What do you mean by a steaming shed?—This is the only shed here which was steaming in Burnley.

3378. It was a humidified shed?—Yes.

3379. In one of the non-humid sheds the relative humidity was 64·67?—And this column here shows the excess of moisture over the outside air, if that is any use.

3380. We will keep this table?—You are welcome to it.

3381. I think Dr. Howarth made some experiments with a view to arriving at conclusions as to what the effect on health would be of working at high temperatures in a moist atmosphere?—That is so; the experiments were undertaken by Dr. Howarth and myself.

3382. I think you have handed in this paper?—I handed that paper in.

3383. Might I ask Dr. Howarth if he will kindly explain this paper to us or will you?—That is with regard to the experiments at high temperatures?

3384. Yes?—I may say that these experiments were undertaken in a room that I have at the mill at liberty, and 8 ft. from each end of the room a standard hygrometer was hung. The temperature of the room is naturally high owing to it being between the boiler house and the engine house. The method of humidifying was by live steam; and the exercise or work done consisted in walking as near as I can judge between three and four miles an hour; and my mouth temperature was taken at various periods during that work. Here you have the details of the wet and dry bulb readings for the back and front hygrometers, and these are the body temperatures and the length of time that the exercise was kept on. I have here the time of starting in all cases.

3385. At each of these periods given a different reading was taken?—A different reading was taken every time—you have it marked here, and the hygrometer readings and the thermometer readings were checked by Dr. Howarth and myself.

3386. That is the same right through, is it?—That is the same right through in the whole four.

3387. Take the first table, the body temperature, that is at the mouth; we find at 3.15 it was 98°, and then 53 minutes after 99°?—At 3.15 it was 98·2.

3388. And 53 minutes afterwards 99°?—Right.

3389. And 85 minutes afterwards it was 99·2?—Yes.

3390. It remained at 99·2 till 150 minutes afterwards, when it goes up to 99·3?—Yes.

3391. The normal temperature being what?—(Dr. Howarth.) 98·4.

3392. May I ask you as a medical man, Dr. Howarth, when the bodily temperature rises above the normal the highest one here is 99·6?—(Witness.) Yes, 99·6. That is after the wet bulb temperature has been raised to 87°, 88°, and 90°. That must be taken into consideration.

3393. The wet bulb temperature at 99·3 was 83°?—83° on one thermometer, and 77° on the other.

3394. Taking this with the wet bulb at 83·5 the bodily temperature was 99·3?—(Dr. Howarth.) Yes.

3395. Which is how much above the normal?—0·9.

3396. Would you, as a medical man, say that if a person worked and continued to work with his bodily

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temperature at 0·9 above the normal, it would in the long run do him injury?—(Dr. Howarth.) I should say it would.

3397. And, of course, in a greater degree if it went up to 99·6. There the wet bulb was at 90°?—(Dr. Howarth.) Yes, that is if continuous work were carried on even with that slight increase it would be prejudicial to health; but a temporary rise of temperature I should not think would be prejudicial at anything under 100°. The normal temperature of the body will rise towards nine o'clock at night perhaps up to 99°.

3398. (Professor Lorrain Smith.) You have determined this, of course, by the rise of temperature. I did not quite follow when you began to feel uncomfortable. Had you any discomfort?—(Dr. Howarth.) There was no discomfort. (Witness.) I had no discomfort unless the temperature rose to about 99·4 to 99·6. Personally, the first feeling of discomfort I had was when my arms began to get wet. Up to 99·3° my arms were quite dry; the body was wet, but up to 99·3° my arms were dry. When they began to get wet there did begin to be a feeling of discomfort.

3399. What was that feeling?—A feeling of oppression.

3400. Of course you were perspiring freely all the time?—After ten or fifteen minutes I began to perspire, but I do not put perspiring down as bodily discomfort.

3401. If it is excessive and it goes on all day, and you have to work, it is not pleasant?—It does not conduce to comfort.

(Dr. Howarth.) Of course, in this room the air was quite stagnant; we had no ventilation.

3402. You have determined that figure of 78° by the rise of temperature?—Yes.

3403. That is a grave matter?—(Dr. Howarth.) Yes.

3404. Discomfort comes on before that?—In what respect?

3405. I mean we have got from witnesses accounts of discomfort where you have no suspicion that they are so bad as to have their temperature raised?—(Dr. Howarth.) You do not expect discomfort to any great extent until the room gets hot. (Witness.) The room got very hot before there was any discomfort. It gets to 83°, 84°, and 85° on the wet bulb thermometer.

3406. We had an account from one of the inspectors of a hot day; the wet bulb temperature was about 80°. We had an account of a case of a hot day in one of the mills where the wet bulb was about 80°, and the workers had evidently come out of the shed; the discomfort was so great that they practically stopped working. That was in the evidence of Mr. Walmsley.

3407. (Mr. Cross.) I suppose the experiment then was for the purpose of finding out when discomfort arises?—That is so.

3408. (Professor Lorrain Smith.) To determine when the body temperature begins to rise.

3409. (Mr. Cross.) What was the experiment for?

3410. (Mr. Roberts.) To show when the bodily temperature begins to rise. (Witness.) It all depends on the exact meaning you put on the word discomfort.

3411. When you are perspiring you are in a state of discomfort, or anybody else?—When the arms are perspiring you feel it then. Up to then I was all right when the body was perspiring.

3412. (Mr. Shackleton.) What about your body underneath your clothing when your arms were perspiring?—I have been quite as wet many a time taking exercise. You cannot expect to keep dry at a high temperature.

3413. At 80° to 81° wet bulb the description we got was "All the weavers had got as many clothes off as they could really take. The tacklers were all out of the room under the stairs. The weavers seemed to be working with great discomfort." The point that I do not follow is that you felt no discomfort: you seem to have been so free from it. The circumstances were worse from a temperature point of view than what is described by this witness, Mr. Walmsley?—Personally I have not the slightest hesitation in saying, as far as being able to feel anything beyond

perspiring, that I felt nothing till I say the body temperature was getting up to about 99·4°.

3414. What clothes did you wear?—I had jacket and waistcoat off as I used to work when I was a taper. My shirtsleeves were rolled up.

3415. That is not the usual dress of a weaver, is it?—In summer time it is.

3416. I have been a weaver 25 years. I have never had my waistcoat off when weaving yet?—I have seen plenty.

3417. (Mr. Cross.) I have never had mine off in the whole of my weaving.

3418. (Professor Lorrain Smith.) Hart's Humidifier can be used with a matting or screen through which moisture trickles, and air drawn through that is cooled; have you seen that at work?—I have never seen one actually at work.

3419. You do not know the results of working?—I think the other gentleman who is coming from the Managers' Association of Blackburn has such a machine at the works he is at.

3420. Is that Mr. Lonsdale?—Yes, he will be able to tell you more about it than I can. I should like to say this at this point with regard to that question of cooling: that I think if an investigation were made as to the temperatures of sheds where exhaust and plenum systems are at work you will find that the sheds where the exhaust system is used are cooler than the sheds where the plenum system is used.

3421. But you have no definite observations on the possibility of cooling by evaporating water in the incoming air?—I have no personal experience, only what I had a dozen years ago. I do not remember the exact details, but at that time we had the Drosophore arrangement in the shed where I am at, which was an arrangement for pulverising or atomising water and evaporating it. I pulled the arrangement out and threw it on the scrap heap for the simple reason that I felt certain in my own mind that the weavers who were near the arrangement suffered from small particles of water dropping on to them.

3422. (Mr. Cross.) That is not quite the same. In your opinion would an exhaust system have any effect in any way of drying the warp in any degree whatever—you pull the air out by what you call the exhaust?—Yes. I do not think there is any difference between the two systems for drying the warp. The whole thing depends on air movement. If you move a certain volume of air either by the exhaust system or by the plenum system it must produce the same effect with the same temperatures.

3423. Will you tell us how you distinguish a movement of air; would you take a light or anything of that sort to see if it moved?—You simply take it by CO₂ tests. You judge the movement of air by the CO₂ test. If you find that CO₂ is low in a shed you may take it that the movement of air in that shed is great. If the CO₂ is high the movement of air is low.

3424. So there is no difference between the exhaust and plenum systems with regard to effect on the warps?—No, I do not think there is the slightest.

3425. I ask because Mr. Osborne said a good deal in that respect, and so did manufacturers. There were two opinions expressed that there was some appreciable effect in the drying of the warps by the exhaust system?—If you are moving a given volume of air at the same temperature, whether you exhaust the air and let a fresh supply in, or whether you send a fresh supply in and drive the old air out, it simply resolves itself into this: that you are moving a given volume of air.

3426. (Chairman.) Is not there a greater risk of short-circuiting with the exhaust system than with the plenum system?—I admit that the exhaust system went into disfavour at one time, and through short-circuiting. At that time I took a number of samples of air at the roof of the mill where I am engaged, and found out that the air at the roof contained less CO₂ than the air at the breathing level. After that I came to the conclusion that the proper place for an exhaust fan was considerably lower down than it is the general practice to put them, and every exhaust fan that I put in now is put in at a height of 7 ft. 6 in. to 8 ft.

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6 in. from the floor. Then the air that enters through the small crevices in the roof and between the panes of glass in the window frames has got to fall and diffuse itself at a lower level than it formerly had to do. That entirely does away with any short circuiting, and does away with any draught near the fans, and it always, I think, tends to keep the temperature down, for the simple reason that a lot of the high temperatures, especially in the winter time, are due to having to keep the temperature of the incoming air higher than it ought to be to prevent draughts.

3427. (*Mr. Shackleton.*) I take it that really your chief objection to the plenum system is the difficulty of preventing draughts?—Yes.

3428. That is your chief objection?—Yes. Mind you, there are some plenum systems which do not give draughts; but a lot of the work that is being put in at the present time—that is, the cheap work—does give draughts; there is no doubt about it.

3429. You seem to have a very high opinion about the weavers following their leaders in this matter. I noticed that in your opening statement you said they had?—I said it was a compliment to the leaders, not that they followed them, which is a different thing altogether.

3430. Can you take your mind back six or seven years on this question of steaming. Can you recall any sentence, let alone publication or speech of any recognised leader in the textile trade (which is the trade we are speaking about) which has advised the operatives to vote against steaming?—I do not think there was any advice given in that direction in a public speech; it would not have been policy to do it.

3431. Do you know any other way; have you any evidence, in any shape or form, that any leader has so advised them?—No; but there is any amount of evidence from the "Cotton Factory Times" that the weavers have been biassed in that direction.

3432. I want the leaders who have been guilty of this thing that you think wrong; I want them localising?—Personally, I do not know; but I would say this: that never in my own experience have I heard your name associated with it.

3433. Anybody else's name?—It has come mostly from the Burnley district. I could not give names.

3434. You do not know a leader who has given advice specially?—I know the agitation has arisen there. Only the last number but one of the "Co-operative News" will give you one or two names of delegates from the Burnley district who spoke strongly against humidification in the ——— shed at ———.

3435. The ——— shed at Bury, I think?—Yes.

3436. I have read that; but none of those delegates, to your knowledge, are connected with the weaving trade as leaders, are they?—I have no knowledge who the leaders are in Burnley.

3437. Only when you make the statement it is necessary for us to find out about it. Another point is with regard to these tests on your body. I suppose you consider yourself a very good subject for a thing like that?—I have no idea whether I am a good subject or not. I had no personal knowledge on the matter. I wanted to have some personal knowledge on the matter, and then I could speak to it.

3438. Your ordinary occupation, before you were a manager, was that of a taper?—Yes; that is 12 years ago.

3439. You worked in a very high temperature?—It is 12 years ago.

3440. You suggest that you could stand more than a weaver in the way of high temperature?—I suggested that in the interest of the weavers. I do not suggest anything against the weavers. I wish to make it as easy as I can for them.

3441. You think it would be a good thing if tests were made not on men who have a special knowledge of this thing, and have an idea as to what they would like the results to be, but that it would be better if we could have some haphazard experiments, taking weavers from a shed to have those tests?—I think it would be very good to have a number of tests; and had there not been the difficulty of waiting till sum-

mer-time, I should have been inclined to make tests myself; but as there was a room at liberty, and the tests could be made now, I thought it best to get them made.

3442. (*Chairman.*) Would you suggest tests in July?—June, July and August. If this Committee, or any members of this Committee desire to have the loan of the room where the tests have been made with Dr. Howarth and myself, they are quite at liberty to have it. I do not mind regulating the wet and dry bulb temperatures, if you wish to make any separate tests.

3443. (*Mr. Cross.*) You said it would be a great increase of cost to have an improvement made in the yarn?—Yes.

3444. Through that there would be loss of trade; that is the sea-borne trade you are speaking of?—Yes, mostly the export trade.

3445. Who would take that from us, do you suspect, supposing we increased the cost one penny per pound of yarn used?—I think the Americans would make a great effort to take it from us. They have recently had a Commissioner over here to investigate the conditions of the sizing trade of Lancashire.

3446. Was not that with the intention of getting to know something of the sizing we did here compared with the sizing in America?—I have a copy of his evidence at home, published by the United States Government, which I think is free to all American manufacturers who care to apply for it.

3447. It was really to get to know something from you and others in similar positions as to what heavy sizing meant?—He did not get any knowledge from me, only what he pinched indirectly.

3448. That was the idea of the Commission?—Yes.

3449. At the present time over there they do not understand heavy sizing?—Quite so.

3450. The conclusion you draw is that they would be the persons to pick up the sea-borne trade?—I do.

3451. With regard to that exhaust system, it was very much opposed, as you know, and it went out of fashion. Could you give us any authorities besides yourself who have made a special study of it that prefer the exhaust system against the plenum system—any authorities, I mean, in the way of ventilating authorities?—I could not; but I know a number of managers who have had so much trouble with the plenum system that they have changed the fans about—that is the cheap methods of the plenum system. I do not know whether it is wise to mention names; but I do not refer to systems such as the Hart, Hall and Kay, and probably Howarth's and Parson's.

3452. (*Mr. Higson.*) The Vortex?—That is not a ventilating system; it is for cooling and humidifying.

3453. It is a ventilating system?—The ordinary Vortex is put in, and you put fans in besides.

3454. (*Mr. Roberts.*) They are also ventilators?—It is a different system altogether. Personally, I am dead against the Vortex. Such systems as those I think can be made to work, and work comfortably; but as to those fans that simply bring air in, with no means of moistening it near, I think the trouble of looking after them, and the first cost, and the liability to draughts in the winter-time, unless there is some tampering with the ventilating apparatus, make it that the exhaust system is far preferable; that is, if you exhaust at a low level, not otherwise.

3455. That is to say, those four systems just referred to would really be for ventilating and humidifying machines?—Yes.

3456. With regard to the others, it has been a semi-plenum system, or shall I say part exhaust and part plenum, you refer to?—No; it is all plenum, as far as ventilating is concerned, only it does not combine the humidifying with the ventilating.

3457. You cannot quote any authority besides your own experience with regard to the exhaust system at present?—No, but I should just like you to go into this matter; you have far better opportunity than I have; and see if the sheds which are on the exhaust system are not all the year round at a lower

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temperature than sheds which are on the plenum system.

3458. With regard to steaming with the old steam jet and pipe which you have—I am not going to ask what you use—would you favour clean water for steaming, or canal water, or lodge water—I am speaking with reference to the health of the operatives?—Personally, I do not think there would be much objection to canal water. Of course, there is a standard.

3459. It is one of those things we have never heard of. Suppose that that were put into operation. We do not know how it happened, but we understood it was clear water that had to be used?—I think there would be canal water that would conform to that standard, but from dirty brook water there is a smell comes off in the morning.

3460. Taking the canal; in some sections of it the water is bad. You said that the operatives were susceptible to catching a chill on account of insufficient clothing or not wearing the kind of clothing that they ought to have. Did I understand you rightly that it was insufficient clothing or not the right kind of clothing?—Let me say on this point that I do not wish to begin discussing the habits of the operatives after they get outside of the shed. I want you to understand that to begin with; but I do think that the men more especially than the women might be far more careful at the meal hours and at the week ends than they are in that respect. If you watch the operatives near any mill, the men I refer to, you will find them in winter time congregated somewhere about the mill or at a street corner, not walking about, but standing still, probably in an atmosphere that may be 20° to 30° lower than the atmosphere in which they are accustomed to work. Now if they were taking a walk up town or anywhere else, moving during that time, I think the change would be very beneficial; but there is all the difference in the world between taking sufficient exercise to keep warm and standing still till you catch a chill.

3461. (*Chairman.*) I think we may take that as being a law of universal application, that people who stand about and are badly clothed will get chills?—It is not a question altogether of being badly clothed, but they should have more clothes on if they are going to stand about.

3462. (*Mr. Cross.*) They might have a room provided to smoke in?—I have let them have the room that I have been making experiments in for a smoke room when I have not been using it. At the other two sheds they go to smoke in the boiler house.

3463. (*Mr. Roberts.*) At what relative humidity do you hope to weave successfully? Give the temperature of your bulbs. Suppose that your dry bulb is 70°?—That depends on other conditions. The relative humidity for successful weaving depends to a great extent upon the amount of air movement that accompanies that relative humidity; that is, if you have a shed that is very well ventilated where the amount of CO₂ is low, you would want a higher relative humidity than if you had a shed where the air was almost stagnant to produce the same effect on the yarn.

3464. In your shed?—In our shed I should say about 80.

3465. If we take it that 80 is the relative humidity required in your shed, you stated that the maximum wet bulb temperature should be 78°?—Yes.

3466. Now during the summer days what is the highest you will get to with the dry bulb?—I have the twelve highest readings for the last three years. The highest reading during the last three years was 90° dry, 82° wet. That is the highest I have ever known recorded at George-street Mills. July 14th, 1905. I find that during the last three years, that is 1905-6-7 there were twelve days on which the wet bulb —

3467. I want the dry bulb?—I will go to the dry bulb afterwards. The wet bulb touched 78° or over.

3468. (*Mr. Shackleton.*) On how many occasions?—Twelve in three years. I had a few figures that I got from Bolton, which show that the outside shade temperature at the same time was about 80° maximum, and the maximum black bulb was 120°. The dry bulb temperatures vary from 85° to 90°.

3469. According to that, you may say that we might get to 86° dry during any summer?—Yes, you might easily when you have a spell of hot weather and have two days running together.

3470. And even 88°?—Yes.

3471. If we were at 88° dry bulb, and we were compelled—that is not allowed to go beyond 78° wet bulb, we should then have a relative humidity of 58 per cent?—Yes.

3472. Could you weave with that?—It would be difficult. I realise the difficulties in going on; but at the same time I am firmly of opinion that the interests of the operatives in these very high temperatures should be considered before the interests of the weaving.

3473. (*Chairman.*) It would be only on very few occasions in the year when you would have those difficulties?—There are twelve occasions in three years.

(*Mr. Shackleton.*) On those days we should have to stop.

3474. (*Mr. Cross.*) Could you give us any idea as to how we should get past the prejudice of some of the workpeople as regards the reading of the wet and dry bulbs?—With regard to that paper handed in, there are four readings to which there is a black lead pencil mark. Those four occasions indicate that a reading from another shed has been put down on the same day. We have three sheds. There are really 12 days and there are 16 readings.

3475. I was asking you with regard to the doubts expressed by some of the weavers with regard to the readings of the wet and dry bulbs. Can you make any recommendation as to removing that prejudice, because we take it that they are correctly taken down, and that the weavers are prejudiced.

(*Chairman.*) Put it some method by which the workers would have greater confidence in the accuracy of the readings.

(*Mr. Roberts.*) It is not only suggested, but stated, that the readings are not correctly recorded.

3476. (*Mr. Higson.*) Have you any suggestion to make by which the weaver can have confidence from now, and say whether the readings are correctly recorded?—With regard to that there is no doubt about it that a number of hygrometers have been hung in positions that are not fair, as I have pointed out in this book. A number of them have been hung on outside walls.

3477. (*Mr. Cross.*) They doubt the readings, even though the hygrometers are hung in the best positions and the right positions from your point of view. What would you suggest could be done in order to put confidence into the weavers that everything is being done honestly?—I could not say. I do not know whether there is such a thing as a self-recording hygrometer.

(*Mr. Roberts.*) There is not.

(*Chairman.*) I think we shall be able to think that out.

(*Dr. Howarth.*) Mr. Chairman, may I just say a word. In Dr. Haldane's experiments he was doing 69·3 ft. tons work per hour. Now, in the experiments we were carrying out, Mr. Scarisbrick was doing 49·5 ft. tons per hour. Of course, Professor Haldane's work was rather excessive.

(*Chairman.*) We went into that this morning. We quite realise that, and we are much obliged to you for pointing it out.

The witness withdrew.

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Mr. THOMAS LONSDALE, called in and examined.

3478. (Chairman.) I think you belong to the same Association as Mr. Scarisbrick?—Yes.

3479. You are by profession what?—Mill manager.

3480. What mills do you manage?—Highfield and Witton Mills, situate at Blackburn.

3481. You know the terms of our reference: you know that we are directed to inquire and arrive at some conclusions as to whether the practice of introducing artificial humidity brings bodily discomfort to the workers, whether it injures their health, and also we have to consider the ventilation of non-humid cotton cloth factories?—Yes.

3482. You have considered those questions, no doubt?—I gave evidence in 1896 before the Commission at that date.

3483. With regard to artificial humidifying, do you consider it a necessity for successful weaving?—I do.

3484. Do you know that there are many sheds that are known as dry sheds?—Yes.

3485. And it is stated that in those dry sheds the same goods are produced as in wet sheds?—In some cases, yes.

3486. How would you account for that fact?—Well, in the first place, of course, there is the composition of the sizing to be taken into account; in the second place, where you have no ventilation, the air not being changed, the yarn is not subject to the same atmospheric changes on account of that non-change of air in the weaving shed; there are no draughts; there are no outlets; you are weaving in the same atmosphere; consequently you are enabled to weave; but I say in the majority of cases—in 80 per cent. of the cases—you would not be able to weave as successfully as in a humid shed.

3487. I take it that in a non-humid shed at times it may be necessary to stop all ventilation?—In a non-humid shed they make no effort to ventilate.

3488. Looking at the comfort of the worker, in which shed do you consider he enjoys the most comfort, the humidified or the non-humidified shed?—By far in the humidified shed.

3489. And in which place does he enjoy the better health?—I should say in the humid shed, because of the freshness of the air, and the humidified air as well. I believe that when he is breathing humidified air, an air which is mixed with the column of air coming in as required by law, he is better off; his health is better; he is able to breathe better, I believe. I believe medical people will tell us that he will be less subject to bronchitis or chest affections.

3490. Of course, it is known to everybody who takes an interest in these matters, that there was a ballot of the workers, and that there was an overwhelming majority in favour of doing away with steaming?—Yes.

3491. Have you any personal knowledge of that?—Yes.

3492. You have read about it no doubt in the paper?—Yes.

3493. You know that there was an overwhelming majority in favour of abolition of artificial humidity?—Yes.

3494. How would you account for that? I mean, why should the workers wish to abolish it, seeing that in your opinion and in the opinion of many other people they are more comfortable in the humid shed?—I believe in a great measure, in a great degree, it is a misconception; secondly, when the leaders of operatives give certain opinions, of course, those opinions are, as a rule, taken up and backed up, naturally; and there is no complaint to find with that.

3495. But the abolition of artificial humidity means, generally speaking, a smaller product, does not it?—Yes. I am afraid if such a thing were to occur as the abolition of steaming that the weavers would find to their own cost, apart from the health point of view, that they would suffer in pocket, and they would have increased work.

3496. If that be so, can you conceive what the object can be? Assuming that this movement was started by the leaders, why should the leaders start a movement which would reduce the wages of the workers?—I can hardly answer that question.

3497. I have tried to get it from a great many people. I have not had an answer yet. There must be some answer. I am afraid we have not had it yet. Some witnesses have told us that weaving could be carried on without the aid of artificial humidity if a better class of yarn were used?—Of that there is no doubt. There are firms, of course—I have one in my mind's eye—which employ very excellent yarn, and their cloth stands well in the market. They do not put a very great deal of size on, and there is no doubt they are enabled to do without artificial humidity.

3497a. Do they only get the same prices as the people who use inferior yarn?—Their name stands well in the market. Possibly they may get better prices.

3498. What do you think would be the effect from a commercial point of view if it were laid down that instead of using artificial humidity a better class of yarn should be used?—If you could get your customers to pay a better price for the cloth we should be only too happy to do that. I should think manufacturers at any rate would be only too happy to do that.

3499. If you could get them to pay the price?—Yes, exactly.

3500. Supposing these goods were made in other countries, would it be likely that they would be able to compete?—That is a point I was going to come to. There is competition. I had not sent a *précis* of my evidence, because I sent up one in 1906, and I did not see that I could improve upon it, although I do not like to refer to it a second time.

3501. That has not come before us; if we had heard of it we should have asked for it?—I happen to have it. If it is of any avail or service I should be pleased to leave it.

3502. Thank you, we shall be glad to have it. Taking the different systems of humidification, what in your opinion is the best method?—There are various schemes, and I think it would be rather invidious for me to name any best method. Every man seems to have the best method; we ourselves have in one shed (I can only speak from experience of our own sheds) Hart's humidifier.

3503. How do you find that answer?—It answers very well.

3504. Hart's humidifier is used in a very large number of places; but one part of his system we have found to be neglected; what I refer to is that on the roof where an inlet is there is an arrangement designed by Hart for placing a sort of cocoanut matting screens, which are kept moist by being placed in water?—I may shorten that. We have those.

3505. Have you used those in summer?—Yes.

3506. With what result?—During the last two or three days I have taken out some figures for the last year for three months—that is the hottest months; June, July and August I have taken, and compared them together with the shed in which we use steam at low pressure.

3507. Steam jets?—Yes, at low pressure. You have my figures here, and can verify them. I may say there is a mistake on the part of our clerk here; I have only found it out in coming along. He has put here 74-73½. I think he means 79-73½, so I have altered it. I mention it so that there may be no confusion about it. I have taken first of all the average temperature of June for the whole of the readings, of July for the whole of the readings, and of August for the whole of the readings.

3508. Last year?—Last year.

3509. That was a cool year?—I am giving you the hot year. It is 1905: that was a hot year.

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3510. Let us have that year?—The average of the shed using steam was $81\frac{1}{2}$ for June, $84\frac{1}{2}$ for July, 82 for August; the average of which is $82\cdot7$.

3511. (Mr. Cross.) That is dry heat temperature?—That is the dry. Now, in the shed with Hart's humidifier for June it was $80\frac{1}{2}$, for July 83, for August 79; average $80\cdot8$.

3512. (Chairman.) So that the advantage was $2\cdot7$?— $1\cdot9$. We have another shed here, which I do not think it is fair to take: I will tell you my reasons why. It is a shed which has also Hart's humidifier in. Mr. Cross will know the shed, for he has worked in it (it is the U—, W—, Mr. Cross). You know it is about ten feet above the level of the lower shed, and it communicates and is connected with the lower shed; consequently it acts as a kind of air duct for keeping the upper shed heated. However, I am giving the reading of that also, but I mention that so that you can allow for it. June $82\frac{1}{2}$ °, July 85 °, August 81 °, an average of $82\cdot8$ °. You see that is 2 ° higher; and that is, as a rule, what I find in that upper shed; it is generally 2 ° hotter in that shed, and always was.

3513. (Mr. Shackleton.) Can you say how many days in the month you had that cooler working?—You may take it, I think, that it would be working during the whole of this period. I could not take oath upon it, but you may take it generally it was working the whole time.

3514. (Chairman.) Have you the outside temperatures?—No. That is 1905. I will give them now if you like for last year. June, in the steam shed, 76 °; July, 80 °; August, $78\frac{1}{2}$ °; that is an average of $77\cdot1$ °. June, 1907, in No. 1 shed, 77 °, 78 °, $77\frac{1}{2}$ °. That is a variation of $0\cdot5$ °. In June, in the second shed, $79\frac{1}{2}$ °, 81 °, 80 °, an average of $80\cdot1$ °.

3515. (Mr. Cross.) What is the average difference between the shed having Hart's humidifier and the steam shed—is it one or two points, or what?—In this case it is not a point. In the latter case I have given you for last year, but in the other case I had it more under my own supervision previous to 1906. Now I trust more to my weaving managers, and we always hope we get a correct record. What I mean is this: that sometimes men take an idea that they can improve certain things by doing certain things in a curious sort of way, and they take it upon themselves to try. Of course, that is a mistake, but there it is. I can speak as to the accuracy of anything at all with regard to the 1905 figures. There were one or two experiments tried, putting a little more matting on in 1907, so that may account for a little of the difference in the figures which you find there.

3516. (Chairman.) It would more or less choke the fan, would not it?—It might prevent a little of the cooler air coming forward into the shed, so it would retain the heat, and the heat would be sustained inside the shed.

3517. You know this humidity table, of course?—Yes.

3518. In your opinion, could it with any advantage be modified with a view to giving greater comfort to the workers?—I do not think so. The greatest enemy, I think, to the weaver, and to the manufacturer, too, for that matter, is the heat. It is the heat of the shed in the summer time.

3519. Can you suggest any method for cooling it?—I am sorry to say I cannot. I think if some method could be found for cooling the air we should hear less of this agitation.

3520. Have you ever been to India?—No.

3521. I daresay you have been discussing matters with gentlemen who have been out there managing mills?—Not with regard to humidity.

3522. Have you heard of a sort of screen made with the Cuscus plant?—I have not.

3523. It is a sort of weed which is woven more or less together, and forms a sort of screen; water is thrown over it, and it is put in the windows and all sorts of places, and air passes through that. We have not the Cuscus here, but by hanging damp screens, say of woven jute, in suitable places, and letting the air come in through that, that might have an effect?—I

do not think it would be sufficiently cooling. I have some memoranda here that may be interesting, in which I refer to a particular day; that day was a Sunday, and I took readings outside the roof of the shed and I also took the reading inside the shed. These were taken in 1896, but the figures bear on matters to-day, because air and water are the same, to-day as as they ever will be, I expect. Above the roof of the shed the air was $79\cdot5$ ° at 10.45, whilst in the centre of the shed it registered 80 ° only. This may be exceptional I grant, but it is typical of what does occur. On June 13th, 1896, it was $81\frac{1}{2}$ ° in the centre of the shed and 86 ° above the roof. On Sunday, June 14th, it was 81 ° at 3.30 in the centre of the shed; at 12 o'clock on Sunday it was $92\frac{1}{2}$ ° above the roof. Now when one comes to figures like this one hesitates to think how one can reduce the temperature in a shed by water or any kind of vapour coming through.

3526. (Mr. Higson.) What do you mean by "above the roof"?—Outside on the roof, above the roof.

3527. (Mr. Shackleton.) Was the sun shining on the roof when you took it?—Yes, it was 91 ° on a very hot day, a Sunday.

3528. (Chairman.) I take it most of the heat comes through the roof?—Yes, we have so much glass in the weaving shed.

3529. Has it ever suggested itself—I am only offering it as a suggestion now, and it may be utterly impracticable on account of cost or otherwise—has it ever suggested itself to anybody to put a sort of coarse screens which might be damped on the roof?—It has not. Supposing you did it and you get an atmosphere of 91 ° above the roof, the solar rays are coming down, and that matting or whatever the substance is that you are going to pass the water or vapour through will also get the terrible heat.

3530. It would evaporate and produce cold.

(Mr. Higson.) Some years ago many firms erected an installation of water-pipes on the roof.

(Chairman.) That would not have the same effect as the cloth, because from the wet cloth there would be rapid evaporation.

3531. (Mr. Higson.) The cost in the first place was very serious, because there is no water except town's water, and even that used to fill up the small sprays we put on; the smallness of the outlets caused them to get made up in consequence of some little fibre that came along with the water. I do not think there is a single firm in town where it is now in use.

(Witness.) I have seen it in use myself. We have never used it. The great heat comes through the slate and glass.

3532. (Chairman.) Taking what is now the law—the whitewashing—does that extend over a sufficiently long period?—Yes, a quite sufficiently long period; I mean to say you could extend it further if you wished, but I do not think there would be anything gained by it.

3533. Take the regulation as to the pipes for conveying steam—I am not talking now of the pipes for radiating heat, but the pipes for conveying the steam for humidifying purposes—could there be any improvement with regard to them?—Only keeping them well covered.

3534. Well covered?—With non-conducting composition.

3535. Do you think if those pipes were reduced in size that would produce any effect?—Well, if you reduce the size of the pipe, and if the pipe at its present size is only sufficient to cover your steaming, you would simply have to put another pipe in.

(Mr. Higson.) Or in other words, you increase the pressure, and therefore the heat.

3536. (Chairman.) Therefore assuming that you cover the pipes sufficiently and properly with non-conducting material, that ought not to be a source of risk?—No, but there is a little heat comes from even the best covered pipes.

3537. Can you do anything to prevent that?

(Mr. Roberts.) I may say here I have had some tests taken, and 12 inches below a well-covered pipe it does not affect the thermometer.

(Witness.) What thickness of material was on?

(Mr. Roberts.) Four inches diameter.

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Mr. T. LONSDALE.

(*Witness.*) If we could adopt a material which would not radiate it certainly would be a good thing, because I certainly do think that the heat is the greatest enemy to us all. It is being able to get at the power of subduing the heat that is the problem.

3538. At what relative humidity, at what readings of the hygrometer, do you look for the best weaving?—Within about 1° of the Act. We like to be on the safe side.

3539. 70°–67°, or something like that?—70°–67° to 67½°.

3540. (*Chairman.*) With a relative humidity of what?

(*Mr. Roberts.*) That would give about 86 per cent. 85 per cent. is 70°–67½°.

(*Witness.*) There is another matter to which I ought to refer. When I spoke at the onset about the operatives' leaders, there is another guilty party in that matter.

3541. (*Chairman.*) We have not found one guilty party yet?—You never will, I suppose, but there are very specious remarks to make. Dr. Stephenson, of course, was the first, I think, to bring this matter boldly to the front, and I happened to have given evidence on the Commission of 1888. He said it was a wholesale slaughter of the inhabitants by the infusion of steam into workshops. Now, to an ordinary mind on reading remarks of that kind what is the result? It fastens itself pretty deep. It is a very strong remark to make.

3542. Who was Dr. Stephenson?—Medical Officer of Health for the Borough of Blackburn.

3543. (*Mr. Shackleton.*) Do you know any doctor that is saying that now, or anything near it?—No, I cannot say I can give you anyone saying that.

3544. Do you know any doctor that expresses an opinion in that direction any way?—No, but this became famous, because he had the position of medical officer of health for the largest manufacturing town in the world.

3545. He was speaking upon a system of steaming which was uncontrolled in any way, was not he?—I do not know.

3546. It was in 1888 when he said that. There was no Act then?—Yes.

3547. (*Mr. Roberts.*) It came in in 1889?—The only point is that he admitted on that Commission that he had not officially been in any weaving shed; yet when people make remarks of that kind you are bound to compare them.

3548. (*Mr. Shackleton.*) With reference to your remarks about the leaders: you know some of the leaders of the weavers, do not you?—Yes, I know a lot of them.

3549. Have you heard any of them make remarks with regard to the evils of steaming at all?—Well,

the one that I have in mind is unfortunately dead; and when a man is dead you have no right to talk about him.

3550. Take the last five or six years?—No.

3551. You cannot say they are following their leaders now, can you?—I do not think so.

3552. If it were told to you on the authority of the manufacturers themselves that from one shilling to three shillings per week is earned less in the same shed through the weavers desiring to have the steam taken out, and that they prefer to have the one shilling or two shillings or three shillings, or whatever it is per week less, would not you consider that a pretty stiff charge on their prejudice?—We have two things to consider: we have the commercial side and —

3553. I mean a weaver who is earning one shilling to three shillings per week less because of changing from a humidified to a dry shed—would you consider that a weaver had nothing but prejudice behind him when he is prepared to have that loss?—I should want to know something more about it before I answered that question.

3554. It has been given in evidence that in the last eighteen months in Burnley, certain sheds which have had steaming have had it taken out on account of objections of the weavers, and the weavers' wages have gone down from one shilling to three shillings per week?—It may be sentiment all the same.

3555. You think it is valued at three shillings a week, then?—It may be sentiment all the same.

3556. (*Mr. Higson.*) Permit me to repeat that incident we had yesterday. A manager of a mill suggested turning the steam off for a quarter of an hour to show us the result. A weaver said, "Well, John, if you are turning that steam off, I'm not going in."

3557. (*Mr. Shackleton.*) We have had it in evidence that where steam had been taken out the management had met the difficulty by changing the dry warp, which would make some difference?—It all depends upon the position. I do not know the particular counts or quality or percentage of size. I should want to know all details, and then I daresay I could express an opinion.

3558. If at your mill there was a reduction of 2s. a week in wages brought about, you would hear about it, would not you?—We should.

3559. (*Chairman.*) We all pay a lot for sentiment sometimes, do not we?—As regards the Burnley district you know, I daresay, better than I know, that there has been a very great agitation there. You know that these agitations are contagious, and leaders of the operatives are unable to control the operatives however much they may wish to do so. They get out of hand sometimes.

The witness withdrew.

Dr. JAMES WHEATLEY, called and examined.

3560. (*Chairman.*) Will you give the reporter your qualifications, doctor?—Doctor of Medicine, Bachelor of Surgery of the London University; Diploma of Public Health.

3561–3562. You are at present Medical Officer of Health for the County of Salop?—Yes.

3563. You were Medical Officer of Health for the County Borough of Blackburn from 1891 to 1902?—Yes, that is so.

3564. I think at that time you gave a certain amount of attention to the question of humidifying?—Yes.

3565. In humid cotton cloth factories?—Yes.

3566. There had been a controversy before you took office?—Yes, there had.

3567. Had any views been expressed by your predecessor?—Yes, both my predecessors had expressed views

3568. Who were they?—Dr. Stephenson and Dr. Barwise.

3569. Dr. Stephenson, I understand, made some statements that rather astonished everybody with regard to the alleged mortality or illness caused by artificial humidity?—Yes, they were very strong statements.

3570. I have no doubt that brought the question prominently before you?—Yes, I have no doubt that was the origin of it. That was before my time, of course.

3571. Still, the fact of such statements having been made with regard to an industry of this kind in one of the principal centres was likely to cause a great deal of concern all over the world?—Certainly.

3572. Then I think you followed up the question. Had you opportunities of visiting mills personally?—Yes, I had opportunities, and to some extent I did visit mills; but you must understand that this depart-

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ment is really under the central government, and one had no real status in this matter. I approached it principally from the statistical point of view.

3573. You were not certifying surgeon?—No.

3574. Looking at it from the statistical point of view what conclusion did you come to in regard to the death statistics of persons working in cotton cloth factories as compared with other operatives in cotton mills?—I came to the conclusion that there was no evidence to show that weavers suffered more than other cotton operatives who are not exposed to artificial humidity. I put it in that way because I would not say that the statistics are positive.

3575. Then you point out a weak point in the statistics, and I think I had better read this paragraph: "The weak point in these statistics, so far as weavers are concerned, is that a very large number of weavers give up this work at a comparatively early stage and take to some other employment (see Census tables 1891 and 1901), and this will no doubt include a considerable number who are not physically equal to the work. It is impossible, however, to estimate the effect of this factor with the means at our disposal." That, I suppose, we may take as your opinion still?—Yes, that is so.

3576. "The figures appear to show (a) that the gross death rate and the death-rates from phthisis and other respiratory diseases of weavers compare favourably with those of other cotton cloth operatives in the borough generally"?—Yes.

3577. Have you had any opportunity of verifying those opinions in late years or of confirming the opinions you then formed?—I have seen Doctor Greenwood's figures, and I consider that although they do not altogether coincide, generally they point to the same conclusions.

3578. You point out that the death rates are improving from year to year. Is that based upon Dr. Greenwood's tables?—On Dr. Greenwood's tables.

3579. "I think the records of sickness kept at the factories would be of great value in throwing light on the subject." By whom do you suggest that records of sickness should be kept?—I daresay there are great difficulties when one comes to the practical working of this, but if records of sickness could be kept (I presume by the masters) it would throw much light upon many diseases that the death rates hardly touch.

3580. Of course, the masters would not be able to diagnose a disease?—No, I take it that the diagnosis of the diseases would not always be very accurate. A good many would be founded upon medical opinion, because persons who are away from sickness have to call in medical advice. Many of them are in receipt of sick pay, and in order to get this, they have to produce a medical certificate; so a great deal of it would be based upon medical opinion. As to death rates, I would point out that death does not occur until perhaps many years after the harm is done; and there are many diseases, such as conditions of rheumatism, that you cannot estimate at all by death rates; the only possibility would be death by heart disease, for instance. It has struck me that if one could have compared the sickness at one factory where there is humidifying with sickness at a similar factory where there is no humidifying one would get very valuable results, though the diagnosis might not be accurate in every case.

3581. Then you arrive at the conclusion that there appears to be no reason to think that steaming as regulated, and apart from high temperatures, was harmful. Now as to high temperatures, supposing that there is steaming or that there is the introduction of artificial humidity in any form, and that the temperature is high, what would be your opinion as to the effect of that upon health?—I should just like to say first of all that I had not considered this very carefully; one's attention has been drawn so much to the question of humidity with condensation of moisture, and the whole idea seemed to be that there would be moisture condensed on the clothes of the workpeople, and that they would be exposed to cold when they went outside; so that I had not considered closely the effect of high temperatures, although I find from my reports I have said that probably the greatest danger was from those high temperatures.

3582. I may say that we attach the very highest importance to the question of the effect upon the human system of working in a moist atmosphere at high temperatures?—Quite so.

3583. And any information that you can give us upon that point would be very valuable?—I am afraid I have no information. I quite agree that in all probability that it is an important point. It has been overlooked to some extent in the past, in that no direct investigations seem to have been made, I mean during the period that I was medical officer of health for Blackburn.

3584. Supposing that it were decided that some experiments should be made, could you give us any practical suggestion as to how they should be made?—No, I am afraid I cannot; but I look upon anything that one might call laboratory experiments as not satisfactory. I think experiments must be conducted under actual conditions of working, and while work is going on.

3585. (*Professor Lorrain Smith.*) What is your objection there? I see you refer to that at the end?—Without being able to produce perhaps any grave objections, I can only say that experiments that are not conducted under the actual conditions of working are often vitiated in a way that one cannot see beforehand. Possibly the workers become to some extent acclimatised—so that a weaver who has been continually working in a moist atmosphere is in a different condition bodily from a person who has not been used to it. There are undoubtedly differences I think in the way the temperature affects people; some are affected more than others.

3586. I think that is admitted. I was just wondering how you found fault. I do think in order to be conclusive the experiments should be under working conditions.

3587. (*Chairman.*) Supposing steam is derived from clean water, and good cloak rooms are provided and satisfactorily used: with regard to cloak rooms in mills constructed after a certain date they are a legal requirement; would you suggest that they should be made universal where it is practically possible? Of course it may be impracticable, because for instance there may be no ground available?—I think so. It is clearly a matter of importance, and I think that there should be cloak rooms in every factory.

3588. Then the Act of Parliament requires that the water used for steaming shall be from the public supply, that is to say that water used for the purpose of producing humidity shall be either taken from a public supply of drinking water of other source of pure water, or shall be effectively purified to the satisfaction of the Inspector before being introduced in the form of steam into the factory, and that all ducts and so on shall be kept clear. I take it that practically such a thing as pure water does not exist?—No, not water that contains nothing else except water—I do not think it does.

3589. It would be very difficult to find. It is left here: "or shall be effectively purified to the satisfaction of the Inspector". I was an Inspector for many years, and I confess I should have been very sorry to have had to decide that question, as to what would satisfy me?—I fancy many others would be in the same condition.

3590. Can you suggest any standard that might be useful for this purpose?—It is very difficult to suggest a standard. I think in a town the ordinary drinking water should be used.

3591. There are many places where there is no public supply?—That is so.

3592. And where water is sometimes taken from a canal?—Yes, that I think is objectionable as a rule in Lancashire.

3593. May we refer to the standard laid down as to flax. That is the only legal standard laid down in the Factory Acts. This is as to flax spinning: "No water shall be used for producing humidity in the air or in wet spinning troughs which is liable to cause injury to the health of the persons employed or to yield effluvia, and for the purpose of this regulation any water which absorbs from acid solution of permanganate of potash in four hours at 60° more than 0.5 grain of oxygen per gallon of water shall be deemed

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to be liable to cause injury to the health of the persons employed." It would be probably difficult off-hand to express an opinion as to whether that would be satisfactory for the humid cotton cloth factory?—I do not think it is altogether satisfactory because I recognise the difficulty of applying a standard. I can estimate this pretty well because I am used to deal with this figure in both waters and sewage effluents. It is water which one would consider a good sewage effluent.

3594. Would you mind considering that and giving us your opinion with regard to that. I think perhaps the question could hardly be answered offhand?—Certainly.

3595. We might send a copy of this section 6 to you, if you would consider that and give us your opinion?—Certainly.

3596. Of course, in the wet spinning mills there are troughs that the yarn passes through, but, as you know, there is nothing of that sort in the humid cotton cloth factories?—No.

3597. The water will at any rate have been boiled first?—Yes, quite so.

3598. Where the flax spinning is carried on in those troughs it would not be boiled. Have you any experience with regard to non-humid sheds?—No, I have no experience on that matter at all. The question of the effect of high temperatures does not seem to have been investigated in my time.

3599. (*Mr. Higson.*) There is one point you named, doctor. Many people leave the mill at a certain age, and probably, no doubt, leave in consequence of physical inability to follow that class of work. I think you have found in your experience whilst you were in Blackburn, and from the knowledge you must have had, that many fathers of families supplement their wages by sending their girls to the factory?—Yes.

3600. Then at a certain age the girls go out to millinery and other occupations?—Yes.

3601. There is not much physical inability in the young people?—You mean that the great decrease of weavers at the age of, say, 25 is due to the fact that they can earn better wages in other trades; that is so, and it may mean that those who have found the occupation of weaving unsuitable also leave.

3602. It is a very monotonous business to all weavers?—Yes.

3603. You see the earnings of a great many of the parents of Lancashire families is quite insufficient to maintain five or six children, sometimes more, and they send them to the mill early in order to supplement the family income. Then the boy is taken and apprenticed to his father's business, the girls go to millinery, at any rate, they get out of the mill; that is the desire of the Lancashire operative?—That is no doubt the wish in the majority of cases.

3604. (*Mr. Shackleton.*) I notice in your evidence given before the Committee which sat in 1896, I think it was, you give some figures of averages from 1889 to 1895. No doubt those would be just shortly after Dr. Stephenson made the statement the Chairman has mentioned about the seriousness to the operative of the steaming system?—I think the Act was passed in 1889.

3605. Yes; the statement he made was about the time the inquiry was held at Blackburn, known as the Blackburn inquiry?—Yes.

3606. It was not a special one?—No, the Health Committee Inquiry.

3607. Those figures would follow on from two years at the most after that statement has been made?—I think so.

3608. From 1889 to 1895. Now you give in this statement the weavers and spinners and various other occupations, and then the average of weavers at the same age. I notice in those figures that only in one instance can it be said that the weavers' average is higher than the average of the Borough, and that is between the ages of 55 and 65. All the rest show slightly less, in some cases rather a big amount less. Now can you give us any information as to how Dr. Stephenson came to make the statement he did with this knowledge, or similar knowledge, because we cannot assume that there must have been a big change in two years?—No.

3609. These figures must be on similar lines to the figures that Dr. Stephenson would have at the time he made that statement. Now we not having figures, is it fair to assume that there could not be such a big change in the death-rate of the weavers in the previous five years to this?—There would not be.

3610. Can you, from anything you have been able to discover as a successor of his in your office at Blackburn, justify those remarks?—No, as a matter of fact, these are the earliest death rates, so far as I know, that have ever been got out for a cotton district. Dr. Stephenson's remarks were not based upon death rates. The reason I was able to get these figures was that I had the books down from the Registrar-General, and so was able to make a census.

3611. Can you say what his figures were based on in any way?—I believe there was a high death rate for those two or three years in Blackburn which was to be explained in some way. I do not know anything further. My successor, Dr. Barwise, got out figures, but not having the census he could not get out death rates, so he took the weavers' deaths in the different age periods, and he stated these as a very high percentage at the low age period, and that was due to the fact that the majority of weavers were employed at that age. That was not a death rate at all. Now, as far as I am aware, there is nothing to show in any of Dr. Stephenson's annual reports that he had calculated any death rates whatever in the cotton industry.

3612. The statement has been so often made and referred to of what Dr. Stephenson said that I am anxious to get to know on what it was based?—You can obtain the loan of Dr. Stephenson's reports from the Blackburn Health Office. You will find there are no death rates, so I could not say on what his opinion was based except that there was a big death rate in the borough at that time. No doubt he thought this was a most likely explanation. I might say that in comparing the death rates of the weavers with the rest of the borough, the only fallacy I see is the fact that the class of unoccupied persons, that is, persons who have no trade, always have a high death rate; and consequently the death rates of the trades are lowered to that extent.

3613. Take the comparison with other people, still we come out fairly well?—Weavers come out fairly well. The number in other industries are small. You have that to consider.

3614. It is part of the same industry?—I mean those other departments are small.

The witness withdrew.

EIGHTH DAY,

Tuesday, 24th March, 1908.

At Manchester.

PRESENT:

SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. WILKINSON HARTLEY.
Mr. HENRY HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor JAMES LORRAIN SMITH.
Mr. F. THOMAS.
Mr. D. R. WILSON (*Secretary*).

Dr. MARCUS SEYMOUR PEMBREY, called and examined.

3615. (*Chairman*.) Will you please state your qualifications?—I am a M.A., M.D., Lecturer on Physiology at Guy's Hospital, a member of the Army Medical Advisory Board of the War Office. The experiments noted in the epitome* of my evidence I have done in connection with a Departmental Committee of the War Office of which I am a member.

3616. I think you had an opportunity of seeing, of course, not many, but a few weaving sheds in which artificial humidity is introduced?—Yes.

3617. That was yesterday?—I saw those yesterday. I wanted to see exactly the conditions.

3618. After seeing them are you of opinion that the conclusions that you arrive at generally in regard to this paper would apply to weaving sheds?—Yes, I am, and I would especially draw attention to the point that I did not know was in practice, but which I knew from my own children, that is, I was very glad to see that the workpeople themselves went about without any shoes and stockings in some of the sheds, and the girls had very short sleeves.

3619. (*Mr. Shackleton*.) That is in the carding department, not in the weaving.

(*Secretary*.) That was in the mule rooms.

(*Witness*.) I do not know anything about cotton. I was very pleased to notice the custom. It is what one would expect they would evolve from their own sensations.

3620. (*Chairman*.) I want your impression about the weaving shed?—The one that was moistened, you mean?

3621. Yes?—All their sleeves were turned up there; their clothes were loose at the neck, as they should be from physiological reasoning.

3622. Generally speaking, you think the conclusions you arrive at there in the paper would apply to humid weaving sheds?—Yes.

3623. You have spoken about producing heat stroke on marching soldiers: that, I take it, is in a moist atmosphere?—That is in a moist atmosphere.

3624. Not in a dry one?—No.

3625. You have given us the relative humidity in these experiments you tried?—Yes.

3626. With regard to the CO₂ question, as you point out, I believe there is a general idea that the evil must be looked for in the CO₂, but, of course, it is perfectly understood by the Committee that the CO₂ simply is a measure of other impurities?—Yes.

3627. I do not think the Home Office has ever had suggested any other practical measure for arriving at the purity in factories?—No.

3628. Could any other measure be suggested?—I think they have made the mistake of not testing it from a physiological point of view. They have considered it from a chemical point of view. The bad effects of an atmosphere I can detect at once. If I go up a pair of steps I can detect the difference in the temperature and the moisture, but not carbon dioxide. Temperature, moisture and wind are the important factors.

3629. We have the practical point in mind; although there are very many methods no doubt of measuring impurities in the air, organic or inorganic, they are very costly and elaborate, and for practical use would be difficult?—No, I do not admit that. I say they could take the wet and the dry bulb readings.

3630. I am now talking of the purity of the air, not the moisture of the air?—Yes, but if you have a large number of people in a room and the temperature by the wet bulb is not raised very much, taking into consideration the dry bulb as well, there must be fairly good ventilation, because every time we breathe we give off air at a temperature of nearly 99°, and it is saturated with moisture. The result is this: I could raise the temperature of this room, and raise the moisture in this room without bringing in moisture except from the people. That is why I think the wet and the dry bulb readings should be always taken. The moisture is always very much more easily determined than the carbon dioxide.

3631. How do you get that?—By the wet bulb. I lay much more stress on the determination of the wet bulb temperature in any case in a room than upon the carbon dioxide.

3632. The sheds you saw are what are known as humid sheds?—Yes.

3633. You probably know that in those sheds there is a standard of ventilation laid down by law?—Yes.

3634. That standard is 9 parts of CO₂ in 10,000?—Yes, I know that.

3635. I do not know whether you know—probably you do—that there are other sheds, and a great many of them, in which no artificial humidity is introduced?—Yes. I went into one of those. I could detect the difference.

3636. Are you aware that in the non-humid sheds at present there is no legal standard of ventilation?—No, I did not know that. It was pointed out to us in that shed that there was no moisture, but it was obvious that there was a good deal of moisture from the people.

3637. That would be from breathing and from perspiration?—Yes, that would be from breathing and from perspiration. Every breath that comes out of one's body is saturated with moisture at 99°. A man breathes out—an average man or woman breathes out about 5 litres per minute, and every breath of that is saturated with moisture at 99°.

3638. Do you think it is desirable or necessary that in those dry sheds there should be a standard of ventilation to secure healthy conditions for the workpeople?—I think that there ought to be, from a practical point of view, a wet bulb thermometer as well as a dry bulb thermometer, which would give a check upon the ventilation.

3639. You would suggest that the standard should be measured by the wet bulb thermometer rather than by the CO₂ test?—Certainly, I would.

3640. At what figure would you put that reading of the wet bulb?—Of course, a point like this must be considered as regards the question of the work done

* Appendix IV.

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by the people. If the people can earn more money at a high temperature, then the earning of more money means that they can get better food, and therefore they are able to keep themselves in a better condition to resist injurious effects; therefore I do not want to set a limit which would, by lowering their wages, diminish their power of resistance to bad conditions. I think that it should not exceed 70° wet bulb. My experience of cotton is nil, and I do not know whether 70° would meet the maximum.

3641. (*Professor Lorrain Smith.*) You mean the best conditions of work?—I mean the best conditions of work.

3642. (*Mr. Roberts.*) What would you advise were the best conditions, speaking generally?—You say that on a hot summer's day you could not keep down to 70°.

3643. We have found already existing records of 78° and 79° wet bulb, inside, of course, and I believe as far as 80°. Those, of course, are exceptional days, but when you get into July and August we might find many records of over 75°?—Would not it do to cool the roof by using the method they use at Oxford, letting water trickle over the roof?

3644. That has been tried, but sheds are very large in area, and piping is a very costly thing, and has been found not to keep in good repair?—How many days do you think you would have in the year when it is above 70°? Would that be a big proportion?

3645. In the two months, July and August, we should have at least half of the days with a temperature about 70°?—That would be thirty days a year. As I mention in my paper, I think the natural conditions should be taken into account. But can you work for ordinary purposes throughout the year below 70° wet bulb?

3646. Yes, we can work all right, and if the outside temperature would allow us to come down to that it would be all right for our working?—In most cases the outside temperature would allow you to do that, because if you raise the carbonic acid you can get the moisture partly from the people.

3647. You must not forget this: that we are bound down by law to keep our carbonic acid down to 9 volumes in 10,000?—I think, myself, that is too rigid. The moisture and heat are the factors which do your people harm.

3648. (*Chairman.*) I intended to follow it up by asking you this. As the law now stands under the Cotton Cloth Act, the purity or otherwise of the air is measured by the CO₂ test?—Yes.

3649. That is according to Act of Parliament. Now you have suggested another method, that is the wet bulb reading. But we will say that on account of the law as it stands, or for other reasons, it is considered desirable to measure by the CO₂ test, what would you suggest as reasonable for the dry sheds—and when I say reasonable, I mean from the health point of view?—The dry sheds are not strictly dry. Taking that into account physiologically, they are not dry sheds; they are so-called dry sheds. I should say it would be much better to have 12 parts of CO₂ per 10,000 as a general rule; but if there is a fog you must take into account what the carbonic acid outside is. It may be more outside. I would not be fair to convict the factory owner if the CO₂ outside might be 10 or 14 volumes per 10,000. It would be obviously unfair. I know there are cases in which the carbonic acid in a factory has been determined without any check of the carbonic acid outside.

3650. (*Mr. Shackleton.*) I should like to point out here that the law is now not 9 parts in 10,000, but 5 parts over the outside air?—I did not know that. It did not state that on my paper. (*Chairman.*) I do not think it is the law. (*Mr. Shackleton.*) That is what is actually carried out. (*Chairman.*) If you had to go into Court and take a case before the Justices I do not think that it is the law. (*Mr. Higson.*) Proceedings would never be instituted if the CO₂ did not exceed five parts over the outside air. (*Mr. Shackleton.*) That was understood. (*Mr. Roberts.*) I should like to point out that the evidence we have had put before us so far from manufacturers is this. The gentlemen who work those mills tell us without exception that they must

have from 75 to 88 per cent. of relative humidity to work successfully. (*Chairman.*) There is a large number of mills where you find it is far below that. (*Mr. Roberts.*) I think not, where they humidify. (*Chairman.*) I think so.

3651. (*Witness.*) I can give you the dry and wet bulb temperature for the one I saw yesterday. In the wet shed I saw yesterday it was 71·5° and 66°. I could work in that quite well, I am sure. (*Mr. Roberts.*) That is 73 per cent. of relative humidity. But speaking generally I think in the evidence that has been given before us they have stated that they must have from 75 to 88 per cent. of relative humidity. (*Chairman.*) What was that very heavily sized weaving shed that we went into during our last visit? I believe it was considerably below that?—(*Mr. Higson.*) —'s, at —. (*Mr. Shackleton.*) 61-57½, 63-59. (*Mr. Roberts.*) That is 79 per cent. (*Mr. Shackleton.*) 57-51, 61-56½; those are the readings from the glass when we were in the shed that morning.

3652. (*Witness.*) I think from a physiological point of view there has been a good deal of confusion—I will not say amongst manufacturers—but physiologically the important thing is the wet bulb. There is a mistake I think in considering relative humidity: I would abolish the term from a physiological point of view, and simply take the wet bulb. If I were asked to work at a temperature with the bulbs at 61° and 56° I could do very much more work than if I raised the wet bulb temperature to a higher degree even with similar relative humidity. That is what I think from a physiological point of view is most absurd. I looked through that schedule.* As a physiologist I could not understand how that schedule was constructed. If I may say it without want of respect, it was nonsense from a physiological point of view.

3653. (*Mr. Roberts.*) You see, Doctor, we are not all physiologists. Some of us are manufacturers, and unfortunately in the summer time, not in what we may term very hot times, we get over 80° dry bulb. When we are at 80° dry bulb many manufacturers would tell us that they could not work successfully the material if their wet bulb was below 75°. That is when the dry bulb is 80°. If you get it up to 88° dry bulb, then they would tell us that they could not work successfully if the wet bulb was below 81°?—I should say that they should not be allowed to work on those days; and that the people should be expected to do so is iniquitous from a physiological point of view—that is to work at a wet bulb temperature of 81°.

3654. Can you tell us how we can alter those conditions with the temperature outside—we will say a sun temperature of 100° beating down?—Those are exceptional days; that is the sun at midday.

3655. Between three and four o'clock in the afternoon we find the hottest time in the shed?—Myself I should have thought of one thing, which would be a practical point—I should have altered the times of beginning to work in the summer at once. Why is not that practicable? The practical man does so. The farm labourer will go out and do work at four o'clock in the morning to escape the heat in the middle of the day. Why should not the factory worker begin in the warmer months one or two hours earlier in the morning and leave off in the hottest part of the day? As a physiologist one would say, Do the work in the cooler part of the day, as soldiers do in India, and as a farm labourer does in this country. Is there any objection to that? That is a practical suggestion.

3656. (*Chairman.*) I think we may look at it from another point of view—that the days that have been described will perhaps number three or four in the year only?—I was told there might be thirty days like that in the year.

(*Mr. Roberts.*) In a warm year.

3657. (*Chairman.*) I think on looking through the readings for a great many years we have found there are only a few days in the year where the temperature is over 75°, consequently it is not, after all, a very serious question, even if it came to the very last resort of stopping work?—To give them a holiday is excellent, I think; but then, of course, they would

* Schedule A. Maximum Limits of Humidity.

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lose money. I suggest that when it is a very hot summer they should do the work two hours earlier. It is light at four o'clock, or even at three o'clock.

3658. (*Professor Lorrain Smith.*) It has been suggested also that on those hot days we have a large difference outside between the dry bulb and the wet bulb, and that that difference might be used for cooling purposes: that you could evaporate water into the incoming air, and it would cool down?—Yes.

3659. Have you any experience of ventilating for the sake of cooling as well?—No, I have no experience of that. That would be more costly than altering the working time of the day.

3660. A great many sheds have already plenum ventilation. What they would need to do would be to put up jute screens, or something of the sort. Some of the ventilating plant could be so fitted?—That would be an excellent idea; it would actually make it more comfortable in the shed than outside.

3661. In your marching investigation did you notice whether that was a fact—that you have these big differences between the wet and dry bulb?—The dry bulb went up to 80°, or more than 80°. The wet was 67·5°. Those are average figures. It might go to 68°.

3662. You have not had any experience?—Not on that point.

3663. (*Chairman.*) There is only one more question I want to ask. Have you seen a report by Dr. Halldane on the Ventilation of Factories?—I have seen that.

3664. Do you know that he suggested that the figure for the CO₂ should be raised to 12?—I remember that, and 20 when there was gas. That came before me because of the question of the ventilation of the Army Clothing Factory at Pimlico which came up, and I went down there as a member of the Advisory Board.

3665. Are you aware that there was considerable opposition raised by certain organised bodies of medical men to that proposal?—Yes, I know that too.

3666. I think one was some organisation of the Medical Officers of Health?—Yes.

3667. Another was the Certifying Surgeons?—Yes.

3668. Of course that influenced public opinion very considerably?—It does not influence me, because, if I may explain, it depends entirely upon confusion of the test with the injurious factor. The Medical Officer of Health examines a room as regards ventilation by the carbon dioxide test. A room is badly ventilated. The test is the carbon dioxide. There creeps in a confusion between the big percentage of carbon dioxide and a badly ventilated room. Badly ventilated rooms are apparently bad on chemical grounds; but the chief reason why they are bad, as shown by the evidence I have mentioned, is the fact that there is an excess of moisture, a high wet bulb temperature; there is an absence of wind, or rather of currents of air. That is the reason why a room ventilated by a fire is very much healthier than a room ventilated by pipes. The temperature of the room here (*near the fire*) is quite different from the temperature over there (*indicating the door at the other end of the room*). If there were pipes instead of a fire there would be uniformity, and directly you got uniformity there would be degeneration in this case as in all things.

3669. I attach considerable importance to this standard of ventilation because we are dealing with a large trade. We impose certain regulations upon that trade for a purpose, the purpose being the health of the workers. If our regulations are too stringent we are imposing a tax upon a trade; we are requiring the manufacturers to spend a considerable amount of money upon fans and ventilation for apparently no purpose. That is my object in putting these questions?—I say it with full responsibility—it would be a great mistake to put an extra tax upon the manufacturers and to prevent the workers earning good wages, because if you tax the manufacturer unreasonably he cannot afford to pay the workers so well. One must therefore take a reasonable standard. If it is a very hot day, and the workers can work in the morn-

ing, it seems to me that that would pay both the employer and the employee. The workers would escape the bad effects. There is not the least doubt that one's efficiency would be terribly diminished at 88°-81°.

3670. (*Professor Lorrain Smith.*) Do you say that the evils in badly ventilated rooms are temperature, moisture and uniformity?—Yes, on the balance of the evidence not only in this country, but in America and on the Continent also.

3671. What do you say about the suggested evil effects of volatile organic matter, bacteria, and so on?—I think that is very much over-estimated. The smell from workpeople varies according to the amount of sweating; the more they sweat, the more they smell. That is what one notices generally with soldiers. The smell may be unpleasant, but I do not think it is injurious like a rise of temperature and a rise of moisture.

3672. What do you mean by injurious?—It is unpleasant, but I do not think it is directly injurious to health.

3673. In what sense?—That is that it lowers their vitality—I do not think it does. Sewermen are very healthy men.

3674. The atmosphere of sewers?—The atmosphere of sewers is relatively free from bacteria, but there is plenty of smell.

3675. Then you consider that it would be an advantage to take this testing of the moisture by the wet bulb as a substitute for the CO₂ test?—I think there should be a CO₂ test as well, for this reason: that a manufacturer might say: It is a dry shed; he might raise the moisture by making the people supply the moisture themselves. That would be detected by the carbonic acid.

3676. It would be detected by the wet bulb thermometer?—It might, but the difficulty might be this: it might be a cold day, and the CO₂ be unreasonably raised. I think it would be better to lay most stress on the wet and dry bulb, and then in the second place take a reasonable standard for the carbon dioxide.

3677. In referring to the wet bulb as a means of getting at the condition, your reason for preferring that is that it is direct evidence of one of the deleterious conditions?—Yes, a warm moist atmosphere prevents one sweating.

3678. Whereas the carbonic acid test is indirect?—It is only a test—I can work in a room—I have tried it—with 60 volumes per 10,000, which I do not think you will find in any of your weaving sheds.

3679. Have you ever breathed more than that?—Yes, I have tried up to 11 per cent.

3680. What is 11 per cent. when you come to 10,000 parts?—1,100 parts per 10,000.

3681. What did you find?—One feels tremendous flushing of one's face and difficulty in breathing; one must give in very quickly; but at 60 volumes per 10,000 I have had doctors come into my room, doctors who were physiologists as well as doctors, and therefore knew something about this physiological question, and they could not detect it if the room were cold. I would suggest with all deference to the Committee that it would be a good thing to take the Committee into a room containing 60 volumes per 10,000, but kept cool—it would be only known to one member of the Committee—and see if the members of the Committee could detect it. There is nothing like making experiments one's self. There is no danger.

3682. I have another question to ask you upon this subject. When do you begin to feel directly the presence of CO₂?—One should begin to feel it at about two or three per cent.

3683. Another witness we have not had yet, I understand from the abstract, says he has found three per cent. distinctly invigorating?—I do not agree with that when one is doing work. When one is doing muscular work, one is more sensitive to any change, because one gives off more carbonic acid one's self. Directly one does work, one may give off five or six times as much carbonic acid.

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3684. (*Mr. Higson.*) You advise the keeping of the wet bulb low?—Physiologically, I advise the keeping of the wet bulb as low as it can be, compatible with the working of the cotton.

3685. What do you suggest as the comparative difference?—I should say that, if possible, it should not go above 70° , except on exceptional days. I would not like to take too rigid a standard, which would cut down the wages of the people who work. Good wages give them a possibility of getting good food. If one gets good food one can resist injurious effects much more easily.

3686. Supposing ventilation and humidity were cut off on hot days, how would you regard that?—If the temperature outside is 80° dry and 75° wet, which was given to me as a possibility.

3687. No, that is the shed temperature. Say the temperature outside was 80° and the other figure 67° , then the people inside breathing would breathe out air at a temperature of 99° saturated with moisture, and the temperature of that shed would be steadily going up.

3688. No doubt, but you would be pouring in hot air. Do you think that a good arrangement?—No, I think under those conditions the air should go in cold; you should cool it if possible. A better arrangement, still, I think, would be to do the work in the early morning.

3689. (*Chairman.*) To pass to another point: with regard to these experiments you have brought out perfectly clearly the effects on pulse and temperature with a view to understanding the conditions of heat stroke?—Yes.

3690. In our reference we have to deal with a condition which is a good deal short of heat stroke, namely, bodily discomfort?—Yes.

3691. You do not tell us anything about that. Could you enlarge upon that point in relation to those experiments?—The difference is this: the experiments on the soldiers were of short duration, two hours; but more severe work than the work in the sheds. The work in the sheds is of longer duration—much longer—10 hours, I believe. Now, as regards discomfort. The discomfort of doing this definite amount of work at 79° to 67° is marked. A man will come in, and simply shake like that (*illustrating*). The men's hands will tremble. They can do the same amount of work if one lowers the wet bulb temperature by 10° , and come in with no sign of discomfort. Discomfort means inefficiency. It is against the interest of the manufacturer that the people should work in discomfort.

3692. The point we want to get at is at what degrees of temperature and humidity combined bodily discomfort arises?—There is the personal equation. At 70° wet bulb, I believe a large number of people would show signs of discomfort. There is the personal equation. I noticed it yesterday. There was a dry bulb temperature of 76° . I was very interested to notice yesterday that there was obviously a big personal equation. Some people feel it more than others. Two of the operatives actually at this temperature kept their shawls right over their heads and shoulders; they, therefore, were not suffering distress. One must take that personal equation into account. Some people feel a temperature to be distinctly uncomfortable which to other people may be comfortable; they may, therefore, quite truthfully give entirely opposite evidence upon that point.

3693. (*Professor Lorrain Smith.*) Does that apply to both wet and dry bulb?—That applies chiefly to the dry bulb; in a less degree to the wet as well.

3694. (*Secretary.*) Perhaps I may say this. In the non-humid shed, the dry shed, we went into, you took the readings, I think?—I think it was 76° . There was no wet bulb.

3695. (*Professor Lorrain Smith.*) Then you think that the limit of 70° wet bulb would deal satisfactorily with the question of bodily discomfort?—I think so.

3696. And you would be quite safe from heat stroke?—I think you need have no fear of heat stroke in this case with the work that is done.

3697. (*Mr. Hartley.*) In what district was the mill that was visited yesterday?

(*Secretary.*) —; —, one dry shed and two humid sheds.

(*Mr. Hartley.*) Where the temperature was found to be 76° , was that the dry shed?

(*Secretary.*) Yes.

3698. (*Mr. Thomas.*) Suppose, with a wet bulb of 70° , the dry bulb was 72° , would you consider there would then be bodily discomfort?—I think there would be discomfort.

(*Mr. Roberts.*) That would not be allowed. 72° - 69° it would have to be.

3699. (*Mr. Thomas.*) Take the case of 69° wet bulb and 72° dry bulb, do you consider that in any way disagreeable to the operatives?—I would allow that certainly, because I have done harder work than that at 79° - 67° . That is not a very big difference.

3700. But you see the percentage of relative humidity is very great at that?—Physiologically that does not worry me.

3701. (*Professor Lorrain Smith.*) You lay great stress on the temperature as well as the humidity?—Yes.

3702. (*Mr. Shackleton.*) The relative humidity is a very important point from the manufacturer's point of view. That has been their case all through, that they must have a certain amount of relative humidity. It is not the wet bulb alone; it is a question of what the wet bulb is along with the dry. What I am concerned with is whether it is of as much importance to us as operatives from the point of view of health. I gather from you that the relative humidity is not important to us from the point of view of health, but it is humidity itself?—The wet bulb is the important thing to you medically.

3703. I would like to put to you a case which is going on at the present moment. About half of our sheds are what is known as dry sheds—that is, there is no artificial humidity. Probably if you could get the figures from the whole of those sheds I should think the average of CO_2 would probably be about 15 volumes, rather more at present in cold weather; but if you take the year round at various temperatures and various times of the year it would probably average 15 parts in 10,000, and it would get as low as 12. We have known cases where it has not got as high as 15 parts, but taking an average of 15 we should not be far wrong where there is no artificial humidity. Now I want to know what your opinion is as to the health of the workpeople. There is no other consideration brought in?—What would you take as the dry bulb temperature?

3704. It would get up to 80° ?—But generally it would be below that?

3705. The wet bulb would not exceed 70° except in exceptional cases.—And the dry bulb would generally be what?

3706. 8° or 9° higher than that. The point I want to get at so far as I can gather from you is this: You say that the main point is the wet bulb. That never gets high in the dry sheds. The only point that concerns us in the dry sheds, so far as we have been able to gather information from medical men and others, is the CO_2 . They have always made a special point of what the CO_2 gets to in those sheds, and they say it gets too high, and when it gets too high it is injurious to the workpeople. You say from your point of view it is not an important matter?—It is not the CO_2 as CO_2 . What I want to point out is this: if you raise the carbon dioxide to 33 parts per 10,000 that is no longer, strictly speaking, a dry shed.

3707. (*Mr. Hartley.*) Mr. Shackleton seems to be assuming that 15 volumes in 10,000 in dry sheds is an ascertained condition.

(*Mr. Shackleton.*) It is from all the ascertained figures that we have. The secretary has the return.

(*Chairman.*) I should like to explain that we have a certain number of readings. At present we may take what Mr. Shackleton says as an assumption, to be verified afterwards. You have had a letter from the secretary in which it is explained that we are going to take a number of readings in the dry sheds to ascertain more accurately than we have at present the

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relative humidity; and before we draw up our report our conclusions will be based upon that, not upon any assumption.

(Mr. Shackleton.) What I am speaking about is the records which the Home Office already have, that the CO₂ is not more on an average than 15.

(Chairman.) You are basing it on 15.

(Mr. Shackleton.) I am basing it on 15. I am suggesting that it is 15. It may be more or it may be less.

3708. (Witness.) I understand it will be for the Committee to decide hereafter whether 15 is a proper basis. (Mr. Shackleton.) I put it if it is 15. (Secretary.) Samples are taken as a rule in winter, therefore the average is very much higher than ought to be the case if taken generally throughout the year. In winter I should think Mr. Shackleton is probably approximately right. (Mr. Hartley.) I do not want to pursue it, but I do not want Mr. Shackleton to found an argument on anything that is incorrect. The Manufacturers' Association took some three or four years ago a larger number of tests than even the Home Office. They were more widespread. We took all the sheds in Nelson, and our figures are very different. (Chairman.) Are those summer tests? Can you tell us what they came to approximately?—(Mr. Hartley.) My impression is that the average was over 20. (Chairman.) Those are a certain number of tests taken by Dr. Pickard. I think there were only some twenty of them. However that may be, the Committee so far have agreed that our data on that particular point are not satisfactory, and we have in the paper that has been sent to you by the Secretary arranged that we shall have further data, and when we come to draw up our report we will draw it up upon those data. (Mr. Higson.) On the Committee's finding. (Chairman.) On the Committee's finding. In the meantime

Mr. Shackleton put a possible case, and we might have an answer.

3709. (Mr. Shackleton.) I say if the average is 15 without artificial humidity, and taking for granted that the 70° wet bulb is scarcely ever reached except on exceptional days, would you consider that an unhealthy condition?—No, if they were reasonably clothed, as the women seem to be reasonably clothed. I would say in that connection also if they are given plenty of facilities to drink it is better. One cannot sweat unless one drinks, and they ought to be given facilities. I understand that they can get tea or any drink they like at any time. They ought to have those facilities. I think their method of clothing themselves with a shawl when they go out is very good indeed. I have noticed especially the way they can twist the shawl. I think if they came out with a shawl properly put on there would not be any excessive cooling. They should, as they do, have their sleeves short to increase the sweating. That I think should be imperative in the case of young children. In the case of boys and men they do it. It is to their advantage. I would do it myself from a physiological point of view. I would go barefooted, and with my sleeves up, and with the shirt open at the front. I think they could work under those conditions quite safely. But there might be some exceptional persons who would feel it more than others. I would like to impress upon the Committee the point about taking into account external conditions. But the most important thing I have done is to suggest that you should not work in the warmest part of the day when the air outside is very hot and moist. I think that is a practical and reasonable suggestion. I would like to impress that upon the Committee as my most important suggestion. (Chairman.) We should want a new Factory Act.

The witness withdrew.

Dr. ARTHUR EDWIN BOYCOTT, called and examined.

3710. (Chairman.) Will you kindly give us your Degrees?—I am an M.D.

3711. And a Fellow of Brasenose College, Oxford?—Yes.

3712. You are Lecturer on Pathology at Guy's Hospital?—Yes.

3713. I think perhaps the best course would be if you would be kind enough to do so to read your paper, and then the members of the Committee might take some notes and ask any questions afterwards by way of explanation on any points that they do not understand. (The Witness read a paper to the Committee.)*

3714. You mention, Dr. Boycott, that you have had no personal experience of the conditions of work in humid cotton factories?—That is so.

3715. That was when you wrote it, but since you have had an opportunity of going through some humid cotton cloth factories?—The Secretary was good enough to take me yesterday.

3716. You saw how many, may I ask?—We saw four rooms I think it was in one mill. It was only in one mill. (Secretary.) They were one dry and two humid sheds.

3717. (Chairman.) May I ask after seeing those weaving sheds whether the conclusion you have arrived at in this paper would apply to them?—Certainly.

3718. Have you realised the difference between what is called a humid shed and a dry shed?—Yes. The humid sheds as I understand are the ones that are artificially humidified.

3719. That is so. Are you aware that in a shed where artificial humidity is introduced there is a legal standard of ventilation?—Yes.

3720. Nine parts in ten thousand of CO₂?—Yes.

3721. You saw one shed that was not artificially humidified?—Yes.

3722. Do you know that in sheds of that kind there is no legal standard of ventilation?—So I understood.

3723. You say in this paper: "My own experience of the effects of hot moist air has been derived from laboratory experiments and from observing the influence on myself and others of the conditions obtaining in mines. Hot dry air (over 75° F. dry bulb), especially if still and free from currents produces a well-known feeling of 'slackness', and I have found that this is associated with a distinct fall of blood-pressure. The important element seems to be the skin sensations, and draughts are to a great extent capable of restoring a feeling of liveliness. With a healthy man, at rest and lightly clad, the temperature of the body is not altered. Whether any definite pathological effects are produced is doubtful; but the diminution of mental and physical energy is of importance." Those questions relate to dry air?—Yes.

3724. I think the general conclusion that you come to is that in a hot dry atmosphere the effects on health are not likely to be serious?—No, I do not think so.

3725. Do you happen to have read the report of Dr. Boobyer, the Medical Officer for Nottingham?—No.

3726. In the Nottingham lace trade the temperatures go to a very great height, up to 100° or 110° sometimes; but from the CO₂ point of view the air is pure, and although there is no ventilation, the air is circulated by a fan. That seems to confirm your opinion that the dry air will not be seriously injurious?—No.

3727. "If hot air is at the same time moist, much more serious effects may be produced. These effects are directly dependent on the absolute reading of the wet bulb thermometer, and are relatively independent of the dry bulb temperature." There is a definite and important statement I would like to put to you in the form of a question. Working in a hot moist air is likely to be much more injurious than working in hot air where it is dry?—Yes.

3728. And you consider that from a physiological point of view the condition of the air should be measured by the wet bulb?—Yes, entirely so.

3729. You go on to say "At rest and stripped I found that my body temperature rose rapidly if the wet bulb

* Appendix V.

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exceeded 88°-90° F. with a dry bulb of about 100°, though no rise occurred with a dry bulb of 110° and a wet bulb of less than 85°. I have on many occasions spent periods of about an hour in doing ordinary laboratory work in air with the dry bulb at 95° and the wet bulb at about 65° without any material discomfort. If, however, the wet bulb rises to 88°-90° one's body temperature soon begins to go up even when completely at rest, and one becomes exceedingly uncomfortable and on occasions feels very ill. These sensations can be to some extent remedied by local cooling of the skin (e.g., cold water at the head), but the rise of body temperature is progressive, and must eventually end in heat stroke." Does what I have just read express your opinions or views on that point?—Yes, those are the results of experiments made directly to elucidate that particular point.

3730. "The effects are much exaggerated by muscular work." You consider that those effects would be exaggerated by muscular work?—Yes, very much so. Those experiments were done in a condition of very complete rest.

3731. Your conclusions are based on experiments?—Yes, those were done by myself.

3732. The experiments were in a Cornish mine?—That is the experience I have had of the effects of it.

3733. Are you speaking of yourself there?—Yes.

3734. Then this paragraph will probably explain the effects of going into a Cornish mine?—Yes.

3735. "With fairly active work in walking about in a Cornish mine I have been reduced to a profound degree of exhaustion in air saturated with moisture and varying from 78° to 93° F. Moderate work causes the body temperature to rise quickly with a wet bulb temperature of much less than 88°. 75° F. is sufficient under these circumstances to produce an unpleasant rise. Severe work, of course, raises the body temperature considerably under any circumstances of air temperature. The rise accompanying vigorous outdoor exercise does not, however, usually cause particularly unpleasant sensations owing to the fact that the wet bulb temperature is generally sufficiently low, and the clothing appropriately adjusted, to allow sweat to evaporate freely and so cool the skin." Do you think that people habitually working in moist atmospheres at high temperatures become accustomed to the conditions?—They seem to be accustomed to them in the sense that their body temperature does not seem to rise so much, and they do not complain of the effects so much. I think, as far as the miners are concerned, they become accustomed and learn to be exceedingly skilfully lazy and do not take the slightest exertion that is unnecessary.

3736. We are dealing with weavers who must exercise all their energies both in hot weather and in cold weather; they must work up to their full powers. Do you think that they would become accustomed to working with comfort in such temperatures?—I think up to a certain point they would. Yes.

3737. Could you suggest any point—I mean, perhaps, from the reading of the wet bulb?—No, I would not do that. I do not think there are enough data one could go on to define any definite point. It is quite clear from what people who work in hot air tell one that they do feel it less as they go on. In mines, if they have been off work for a week or so, apart from being ill, they feel the heat on the first day underground very much more than they generally do.

3738. (Professor Lorrain Smith.) Would that affect their temperature substantially—would that raise the temperature?—I do not think it does in those men, as far as we can ascertain.

3739. It is more discomfort?—Yes. Our own temperatures were always higher than those of the men who were with us, who were, as a rule, under-managers.

3740. You were doing more?—We should do more, because it is more trouble for us to climb up and down ladders.

3741. After seeing the kind of work done by the weavers in the wet sheds what would you suggest as a limit for the wet bulb temperature?—I think 75° or 76° perhaps. I certainly do not think the wet bulb ought to go above that. The work they do is not very

hard muscular work, as far as I can judge, but they have to keep on the go all the time.

3742. You suggest that it should not go above what?—Not above 75°.

3743. Do you think that above 75° they would begin to suffer bodily discomfort?—Certainly, I think.

3744. In the end, do you think their health would suffer in any way?—I cannot conceive that their body temperature should be often raised, almost daily, without, in the end, their becoming more or less impaired in health.

3745. (Mr. Roberts.) Would their body temperature be raised when they become acclimatised to the conditions?—That I should very much like to know, and I am afraid I do not.

3746. You could not answer that question?—No.

3747. If you take your experience in the Cornish mines you would say not?—The temperatures of those under-managers does go up, but it does not go up so much as ours does.

3748. (Chairman.) I think the experience in the Cornish mines was qualified by the words that they had learned to become idle, which would not apply to weaving sheds. I would like to read this: "From these considerations, therefore, I am of opinion that operatives should not be called upon to work with a wet bulb of above 75° F., and that it would be desirable, though perhaps not always practicable, that the upper limit for active work should be 70° F." That is a recommendation, I think, that you rather qualify now, do not you, by saying that they might become accustomed to it?—They might become accustomed to it. That seems to me one of the chief points upon which information is wanted on the matter; as, for example, whether on very hot summer days the actual body temperatures of these operatives does go up or not. I do not know whether that has been ascertained.

3749. You suggest that some experiments should be made?—I think it would be very valuable if one had some information.

3750. (Professor Lorrain Smith.) By active work, what did you mean?—I meant, when I wrote that, more severe work than they actually do. I was under the impression that they did harder muscular work than they actually perform.

3751. You say the upper limit for active work should be 70° F. Can you tell us what idea you form of "active work"?—Any of the ordinary occupations in mining; drilling, shoving tubs about.

3752. A good deal more severe than minding looms? Very much more severe.

3753. (Chairman.) Coming to the question of measuring the purity of these sheds, as we said before, there is a standard of ventilation in the humid sheds. In the so-called non-humid sheds—I say so-called because there is humidity from respiration and perspiration—there is no standard of ventilation. Do you think it is desirable that there should be a standard of ventilation in those sheds?—Certainly, I see no reason why the one shed should be put on a different basis from the other.

3754. What standard, as measured by the CO₂ test, would you suggest? As you point out, of course, the CO₂ test does not actually measure impurities; it is rather a guide?—Yes.

3755. That is perfectly understood, but for practical purposes it has been found to be perhaps the best that can be adopted?—I certainly think so.

3756. Or could you suggest any other method of measuring the impurities in the air—for practical purposes, I mean—one that could be ascertained readily?—No, the other methods that have been tried are all very difficult to do, and not nearly so satisfactory, I think.

3757. You think the CO₂ test is the best?—I think so.

3758. Although not perfect, perhaps, for practical purposes it is the best, you think?—Yes.

3759. Bearing in mind that for practical purposes we have to go by the amount of CO₂, what standard

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would you suggest as a reasonable one to secure the health of the workers?—I would ask that the CO_2 should be kept as low as it can be. I think the question altogether depends on how low it would be practicable to keep it. It would be better if there were only three parts in 10,000; but, of course, that is altogether impracticable. On the other hand, I do not know any definite evidence that 30 parts in 10,000 is necessarily injurious.

3760. Not of the CO_2 , but supposing the 30 parts to be the measure of the other impurities, would they then begin to suffer?—I have no definite evidence to the effect that they would.

3761. As you say, 4 parts of CO_2 in 10,000 would be desirable, but it is impracticable. In the weaving sheds it must necessarily be a larger proportion. What we want to get at is what is a safe proportion to lay down. We do not want to put manufacturers to the expense of running fans and getting ventilating plant if it is not necessary for health. There is only one object in doing it, that is the health of the operatives. Can you make any suggestions as to what would be desirable from that point of view?—I think 10 volumes per 10,000 is a reasonable sort of limit. 10 volumes per 10,000 is a figure that is very frequently reached in ordinary life in ordinary rooms, certainly in my laboratories in which I work it is very often more than 10. At the same time I think it is a figure which in my experience can be very easily obtained without any very exaggerated system of artificial ventilation.

3762. Of course, the conditions are these: that on certain dry days if you introduce a lot of outside air weaving becomes difficult?—Yes.

3763. And it becomes almost impossible with an east wind if you introduce too much outside air, that is, unless you have artificial humidity?—Yes.

3764. And one wants to know up to what extent might the CO_2 go before it became necessary to introduce outside air?—It is very difficult to know where the necessary point begins.

3765. I mean to say from the point of view of health?—I am not quite in a position to define what is necessary from the point of view of health. One knows what is desirable, but there is no point during the course of the impurification of the air in a room—I mean no definite point—where people suddenly become affected.

3766. (*Professor Lorrain Smith.*) In what sense is it desirable?—I think the people would feel better and work better with the lower contents of CO_2 .

3767. (*Chairman.*) To the untutored mind, perhaps, I might say it seems rather difficult to grasp that a question of two or three parts in 10,000 is of real and vital importance from a health point of view, and one wants to get from gentlemen who have studied these questions whether it is really a question of importance.—To take the concrete case which I understand is in point: I cannot say that it is definitely worse for the operatives to have 12 volumes in 10,000 than it is to have 9 volumes in 10,000.

3768. (*Professor Lorrain Smith.*) If that latitude were an advantage you would quite agree to it?—A material technical advantage, you mean?

3769. Yes, a technical advantage to the industry?—Certainly.

3770. (*Mr. Roberts.*) Would you put that to 18 if it were a technical advantage?—Well, you have to take into consideration the magnitude of technical advantage.

3771. (*Professor Lorrain Smith.*) You would not hesitate as far as the CO_2 was concerned?—No.

3772. (*Mr. Roberts.*) You would not say that it would be seriously detrimental to health even if it were 18?—No, I would not be prepared to say it was seriously detrimental to health with 18 volumes.

3773. (*Mr. Thomas.*) Would not that depend on the relative humidity at the time—would not you take that into account in giving that answer to Mr. Roberts?—I hardly think so. I do not see why it should make any difference really.

3774. (*Chairman.*) You say here “cold air, free from unpleasant smell, but containing 3 per cent. of CO_2 , I have found to be a distinctly invigorating mixture.”

3775. (*Professor Lorrain Smith.*) How long did you breathe that?—I was in that for about three hours. It was in a submarine where the air was quite cold.

3776. Did it give you any unpleasant feeling. It was so much CO_2 that you could taste it on your tongue in the same way as you could from soda water, and it distinctly invigorated one. It had been raised to 3 per cent. by men breathing it.

3777. “Moderate work causes the body temperature to rise quickly with a wet bulb temperature of much less than 88° ; 75° F. is sufficient under these circumstances to produce an unpleasant rise.” How long would that be, what time would it take?—An hour and a half or two hours, or something of that kind.

3778. Have you had any experience of a point you do not refer to, namely, the cooling of the air while you are ventilating?—No, I have not come across that in any case.

3779. You have not studied the ventilating plant that draws the air through a saturated screen?—No, I have seen them, but they have failed to work.

3780. (*Mr. Roberts.*) I should like to ask you a question upon a statement you make here: “The ill effects of exposure to cold after being in hot places are, I believe, a good deal exaggerated.” Now we have a great many complaints in our business of our work-people having been in these hot humidified places and then coming out and catching cold. Could you explain what you really mean in this paragraph?—My own impression is that that is very largely a popular fallacy about catching cold after being in a hot place. If one has been in a hot room when the body temperature has been raised it is quite a correct thing to do to reduce your temperature at once. The same fallacy prevails as to drinking cold water when you are hot. Of course, if one has got very hot going about in the open air in the sun the proper physiological thing to do is to cool one's self; you either drink a lot of cold water or bathe in cold water, or do both. It is a practice I habitually adopt myself, and I am rather addicted to outdoor exercises of one kind and another.

3781. Then you would not consider that these operatives have really much to complain about on this score?—I think it is probably very much exaggerated.

3782. In the next paragraph you say this: “Operatives should not be called upon to work with a wet bulb of above 75° F.” Then you go on to say: “The upper limit for active work should be 70° F.” You would not consider that the operatives in a weaving shed come within the category to which that upper limit for active work should apply?—No, they do not work as actively as I meant by “active work”; I should call that light work.

3783. Do you think that even 75° is as high as we can go safely?—Yes, I still adhere to that.

3784. (*Mr. Hartley.*) I suppose you mean by that, Doctor, that bodily discomfort will arise at 75° of the wet bulb?—Yes, after some time, of course.

3785. You have no data to show that there is actual injury to health, but you think bodily discomfort would arise at that degree?—Yes.

3786. (*Chairman.*) Would continued bodily discomfort tend to produce ill health?—I am practically sure it would, but I have no direct evidence upon that point. It is purely a statistical point, and the statistics are very difficult to get about the health of these operatives.

3787. (*Professor Lorrain Smith.*) Have you any knowledge of the effect of working in the hot mines on the age of the workers—I have heard that point raised, and it has been said that although it has not any immediate effect, that is to say, the working in the hot atmosphere, they do not live long and they have to leave their work?—One sees a good many men in Cornwall who have worked in these hot mines continuously for fifty years, and one sees quite a number of old men working.

3788. (*Chairman.*) Another point has arisen as to the quality of the water sometimes used for artificially

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humidifying. Of course, pure water is a relative term. Pure water can sometimes be had from the mains; in other places water has to be had from rivers and canals; and it is sometimes asserted that the health of the workers suffers from the impurity of the water introduced as moisture. Can you suggest any standard of purity of water by which that can be measured? One standard has been suggested, and, as a matter of fact it is required by law in the wet spinning sheds at flax mills in Belfast in Ireland. Perhaps it is difficult for you to express an opinion off-hand on a question of this sort, and it is one that requires a good deal of consideration. If I read that regulation to you you might consider it?—Yes.

3789. I think I have explained that at present there is no legal standard in the Factory Act, but under special rules for regulating the spinning and weaving of flax this has the force of law: "No water shall be used for producing humidity in the air or in wet spinning troughs which is liable to cause injury to the health of persons employed or to yield effluvia, and for the purpose of this regulation any water which absorbs from acid solution of permanganate of potash in four hours at 60° more than 0.5 grain of oxygen per gallon shall be deemed to be liable to cause injury to the health of the persons employed."—Speaking generally, that seems to me a reasonable regulation.

3790. If we gave you a copy of this would you like to consider that, or may we take your answer?—I am not quite clear whether in the humidifying process any actual spray from the water is discharged into the air: I think that is not so?

3791. There are different methods. One method is that the water comes from the boiler which generates the steam used for driving the engines, and the steam that comes from that water is also used for humidifying. In others there is what is called a second boiler, and in that pure water is used, and that we

need not trouble about. But there are other methods of humidifying, and in those water is broken up, it is almost vaporised by various processes—it is vaporised so very closely that you could not tell it from steam, and that is distributed through the different sheds by means of fans and trunks generally, so actually water in whatever form does find its way into mills?—I cannot imagine that much harm could arise from water used in that way unless it was extremely filthy—I mean more than dirty.

3792. We might perhaps send you a copy of that regulation, and you will kindly think it over?—I will, certainly.

3793. I feel that it is unfair to ask anybody to answer a question right off on such a point, which is really a very technical one?—It is.

3794. (*Professor Lorrain Smith.*) It has been suggested to us that on the question of testing the purity of the air it would be a great advantage to combine both the CO₂ test with the wet bulb thermometer?—That is in the dry sheds?

3795. In any shed. Have you thought about that?—They seem to be two different things.

3796. The idea was this: that the evils of an ill-ventilated room are the temperature, the moisture, and the uniformity or stagnation of the air; and CO₂ is an indirect evidence of the presence of impurities, whereas a wet bulb reading would be direct evidence of one of the deleterious conditions?—I felt rather strongly yesterday when I was in the dry shed that one wanted to know what the humidity of that dry shed was, because it was obvious from one's sensations that the air was quite moist.

3797. Would you think it worth while to add to the method of testing the condition of the air by the wet bulb temperature?—Certainly, I think it would be most desirable in a case like that.

The witness withdrew.

Mr. MILES HAWORTH, called and examined.

3798. (*Chairman.*) You are the owner of a weaving factory?—Yes, joint owner.

3799. What is the name of your firm?—Haworth, Harrison and Co., Limited, of William-street Mill, Heywood.

3800. Is it an artificially humidified mill?—Yes, we have just ordinary steam jets, blowing live steam in, not humidifiers.

3801. You introduce artificial humidity by the use of steam?—Yes.

3802. Have you done it all along?—Yes.

3803. What class of goods do you manufacture?—Home trade goods; light sized goods.

3804. Up to about 15 per cent. or something of that sort?—Ranging from 12 per cent. up to 25 per cent., very rarely 25 per cent.

3805. Have you always used steam?—Yes, I may say we have always used steam up to about last April, and then we decided that we would make an effort to do without artificial humidity, owing to the agitation then rife throughout the country, feeling at the same time that we should meet with opposition.

3806. Opposition in trying to do without it?—Yes.

3807. Or do you mean that you would have opposition if you did not do without it?—If you will let me I will look at a few notes that I have got here: they will just give me the points.

3808. Let us be clear on this point before we get to them?—I ought to say, Mr. Chairman, that at that time there was a big majority in the town in favour of abolishing steam.

3809. Was it in consequence of that that you abolished it or tried to abolish it?—We thought considering the nature of the size that we were using it was possible that we could do without the steam altogether.

3810. And that was because you felt that there was a feeling that it should be done away with amongst the operatives—was that so?—That was not the feeling exactly with our operatives.

3811. The general feeling?—The general feeling throughout the county.

3812. There was some reason for your giving it up or attempting to give it up?—Yes, the prior reason was that our shed is not a dry one, but naturally rather the reverse, and difficult to keep within the limit on damp days.

3813. Do you mean that the soil is damp?—No, I mean that the shed itself is a damp shed.

3814. (*Mr. Thomas.*) It means the same thing: the subsoil makes the shed damp?—Our principal reason for dispensing with artificial humidity was knowing at that time that the feeling was in favour of abolishing steaming and we decided to make a real attempt to do without artificial humidity. That was about as near as I can recollect from April to midsummer last year. Our size is pure, and never exceeded 25 per cent., and it is mostly under that. If I had anticipated nine or ten months ago that I was going to have to appear before an assembly of this kind I might have kept things more vivid in my mind, but I never anticipated having to appear here prior to a week ago; I do so with pleasure knowing that this subject is a very important subject for the staple trade of this country. We first tried our original mixing of size; the weaving suffered. The weavers complained of lack of steam. That is a point I wish to impress upon you.

3815. (*Chairman.*) That is after you had ceased using steam?—I ought to say that I did not discontinue steam altogether at the commencement; I cut it off by degrees.

3816. That is important, because we want to know what the effects were with steam and without steam?—The weavers complained of lack of steam. We then altered the mixing altogether.

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3817. (*Mr. Hartley.*) That is the sizing you mean?—Yes.

3818. (*Chairman.*) Speak of it as sizing?—We then altered the mixing altogether, with better results adding more deliquescents—that was to cope with cutting the steam off and help to make it more suitable without the steam, and we did that until the weavers complained of soft beams, and still I had repeated requests for steam from the operatives.

3819. Did they come up as a body or through their representatives?—As a deputation of two or three at once. I had repeated requests for steam on the ground that it made it feel cooler, and this was, mind you, about as near as I can get in midsummer. We had a very hot week I think about midsummer, and they came up at that time complaining about us not having steam in, and their ground was that it made it feel cooler. I am giving you the very words they said to me.

3820. Let us be quite clear about that very occasion: it was that the introduction of steam made the shed cooler?—Yes, the introduction of steam made it feel so, although it was very sultry at the time.

3821. (*Professor Lorrain Smith.*) Was it ventilated the same both times, both with and without steam?—Yes.

3822. (*Mr. Hartley.*) Your fans were working just the same when you were steaming and when you were not steaming?—Yes, they were working under the same conditions. Their reason was that it felt cooler when it was very hot and sultry. Those were the very words that they used to me. We decided then to resume the original sizing which I had altered previously, and return to moderate steaming, after repeatedly being asked to put steam in. They may have had a two-fold object in their minds for asking, although they said it was cooler. This is what I contend for—the hands complained and said it was too sultry: it was not comfortable, and they felt it more comfortable when infusing a little steam, and after we had turned to moderate steaming I have often been told it was the best place in Heywood. You can take that for what it is worth.

3823. (*Chairman.*) Could you, at this point, when you speak of moderate steaming, tell us what was the moderate humidity in your shed?—Well, sir, in very hot weather the hygrometer goes up very high—I dare say that at the time the weavers came up the hygrometer would be 76°. Of course, the humidity would be in proportion to that.

3824. By 76° do you mean the wet bulb?—No, the 76° is the dry bulb at that time.

3825. What was the wet bulb?—Perhaps about 70°; it goes wider as it goes up: I cannot carry that in my mind. The opinion I formed as the result of a lifetime in pure sizing is that artificial humidity is absolutely necessary, and personal comfort is increased when used in a moderate degree.

3826. By absolutely necessary do you mean absolutely necessary for successful weaving purposes?—No, I mean for comfortable working conditions and for their health as well. A humid atmosphere is conducive to health; that is my experience in the shed, more so than a very dry atmosphere.

3827. Which is the better for commercial purposes, for weaving purposes?—A humid atmosphere most certainly.

3828. Within any limits? Would you suggest any limits?—Yes, I have dotted down here the best temperatures as I consider for good weaving; they range from 68° of heat to 65°, or the wet from the dry 3°.

3829. (*Mr. Roberts.*) Do I understand from what you have told us that you tried to do without artificial humidity?—Yes.

3830. And that these weavers would not allow you?—It was not a question of not allowing, but they came up and asked me two or three times, two or three different deputations, if I would infuse a little steam.

3831. Supposing you had not done, what would have been the effect?—The effect would have been that they would not have been as comfortable in the shed; they

would not feel as comfortable. They find a kind of exhaustion as far as I can gather from what they said; that with steam they feel more comfortable, and can work better with a little humidity infused, although as I say it was at midsummer.

3832. This was after they had voted against it or for its total abolition?—About that time it was agitated very strongly throughout the county.

3833. (*Chairman.*) Do you know whether your operatives voted or not?—I do not. The question was balloted upon by all the operatives. My contention is that they came up and requested me to put a little steam in. As I say, they may have had a two-fold object in that.

3834. Had they ever previously to that asked you to discontinue it?—No, they never asked me to discontinue it.

3835. It was purely your own initiative; you tried to discontinue it anticipating that you would have trouble if you did not?—Yes, that is so. We had a two-fold object or reason: that our shed is rather a damp shed, and needed very little, and as I say, we could keep within the limit, or be very humid with infusing very little steam into it, and we thought or considered that there would be very little difficulty on our part to do away with the steam, and do away with the responsibility of the restrictions.

3836. (*Mr. Hartley.*) You spoke about your shed being a very damp shed. How does that dampness manifest itself: how do you know it is a very damp shed?—For this simple reason, that it needs very little pressure of steam infusing into it to bring it up to the limits allowed by the Factory Act.

3837. What I wanted to get was this: is there something special about the subsoil, that is the ground underneath your flags, or are your flags of a very porous nature that the shed floor is covered with, or is your shed buried in the earth, that is, in a hillside?—Our shed is a little bit lower-lying than the street, and, as I may say, is not a modern shed, and in consequence is not a very good airy shed, hence the more easy it is to get the required humidity; and if you keep within the limit of the law I think myself that it is not injurious to the workpeople.

3838. You have told us it is damp. What I am wanting to find out is this: whether that is due to the natural surroundings, that is, to the flags, or to the shed being buried, or is it due to the absence of ventilation? Have you had tests made by the inspector as to the CO₂ in your place, or have you been threatened at all?—Yes, we have had tests made by the inspector, and it was not as well ventilated as the inspector would desire; but still, we are ventilated.

3839. (*Mr. Roberts.*) Did he pass it?—Yes.

3840. (*Mr. Hartley.*) Do you know what the test was?—No, I do not. At the time that the inspector tested the shed for CO₂ it was on a very damp, sultry day; he took it under the worst conditions, but at the same time he passed it; but not only that, we have ventilation: we have what are called Blackman air propellers to propel the foul air out; we have also swivelled closing doors at the ceiling to let air in when we require it letting in, that is in hot weather. I consider it is sufficiently ventilated.

3841. (*Mr. Thomas.*) The reason why you commenced to steam again was that the weavers said they thought it was cooler—you made that statement?—Yes.

3842. Not because they could weave any better, but simply because it made the atmosphere cooler?—Yes, their request was in those very words, that it felt better with a little steam in, and more comfortable.

3843. From a health point of view only?—Yes.

3844. Yours being a damp shed, you know there are hundreds of sheds in Lancashire that are very dry sheds and they do not use steam at all?—Yes.

3845. But you say even in your case it is absolutely necessary to have steam?—Yes, because if there is no steam at all and there is a very dry outside atmosphere, according to the hygrometer it is shown that it requires a little humidity in. I contend that if the dry and wet bulbs get more than three or four degrees apart the shed is too dry.

The witness withdrew.

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Dr. LEONARD HILL, called and examined.

3846. (*Chairman.*) Dr. Hill was good enough to prepare a paper* at a very short notice and send it to the Home Office. It seems that Mr. Wilson has not received it. No doubt, Mr. Wilson being away, it has followed him and missed him, which perhaps makes our examination of Dr. Hill a little more difficult. However, Dr. Hill quite understands what are the questions which have been referred to us, and I think we might base our questions very much on others that have been put to Dr. Haldane and other medical witnesses. (*To the Witness.*) Will you please state your qualifications?—I am M.B., F.R.S., Lecturer on Physiology at the London Hospital Medical College.

3847. Have you, Dr. Hill, given particular attention to the physiological effects of working in hot air, both dry air and moist air?—Yes, it is a subject I have given some attention to for some time. I wrote an article on the subject in a book entitled "Recent advances in Physiology," which I edited some three or four years ago. I wrote the article on this particular subject and looked up the literature of the subject. Then just recently I have been paying special attention to it with regard to caisson disease—compressed air sickness among workers in compressed air, tunnel workers, and so on, a matter upon which I have carried out researches for several years, and also with regard to the contrivance of safe breathing apparatus for use in mines after explosions, and so on—breathing apparatus for saving life in mines. This breathing apparatus, of course, has to be used in conditions where the air is extremely hot and where it may be extremely moist, as, for example, in the case of the recent explosion in the Hamsted Mines, where the temperature was stated to be 127° F. What the wet bulb was I do not know. I do not suppose it was taken. The dress I have been working upon is the Fleuss Siebe-Gorman dress. That dress I have been working upon for some considerable time to make it as physiologically perfect as possible. I have recently been putting the men in this dress through tests on this particular subject, exposing them in hot temperatures either with comparatively dry atmospheres or atmospheres where the wet bulb was allowed to rise up to considerable heights, and the conclusions which I reached confirmed in every way the conclusions of Dr. Haldane. The loss of heat by the body is an extremely complex subject. The loss by conduction, by radiation and by evaporation of water is an extremely complex subject, depending upon whether the body is moved and whether the air is moving or quiet. These things render the whole subject very complex. All these factors come in in an extremely involved way. The whole subject, I think, is very far from being elucidated at present; but Dr. Haldane has made an enormous advance in establishing the simple fact that the wet bulb temperature in hot air alone shows whether work can be done with ease without raising the body temperature.

3848. I think we might point out at once, as, of course, you will realise, that the conditions we are considering will be probably entirely different from the conditions which we have heard described. In the cases you have mentioned, I take it that the workers would be in a sort of dress something like a diving apparatus or something of that sort?—No, it is not so very different from ordinary clothing; but there is a slight disadvantage in the dress.

3849. Would not it retard evaporation?—Not much, because I have specially paid attention to that. The dress consists of a couple of oxygen cylinders worn on the back and a breathing bag in the front. There is no tunic. The men work stripped to the waist. It has a small mouthpiece. There is no helmet on the head or anything of that kind. The whole thing is designed to allow loss of heat to the utmost.

3850. Would not the extra effort of breathing under those conditions rather tend to raise the temperature of the atmosphere?—No, there is no extra effort in breathing. The supply is arranged so that there is no extra effort in breathing. The only thing that makes

it somewhat disadvantageous is the weight of the apparatus, which is 30 lbs. to carry, and, secondly, the fact that the carbonic acid exhaled is absorbed by caustic soda, and the caustic soda becomes heated with absorption, which makes the expired air hotter than it would be otherwise. That makes the conditions slightly disadvantageous.

3851. I think you have not had an opportunity of seeing cotton weaving sheds?—No, I have not.

3852. We should explain that the workers there work, generally speaking, in the ordinary clothing such as would be worn in their houses—is not it so?

(*Mr. Thomas.*) Yes, perhaps with the exception of a jacket or coat.

3853. (*Chairman.*) When they go to the mill they take off a shawl or cloak, or whatever it may be, which is hung up, and they just work in their ordinary clothes. Bearing that in mind, and that they are engaged in active work—certainly active work, I should say, but not lifting any very heavy weight—at what atmosphere as measured by the wet bulb would you consider they would be likely to suffer from bodily discomfort?—I should say with Haldane it is quite impossible to work at wet bulb temperatures which were admissible under that table, wet bulb temperatures at 85° and so on.

3854. The table being the official table?—The table being the official table. In my experience it would be impossible to do work at a wet bulb temperature of 85°. Those men that I have been observing lately move a few bricks about from one place in the chamber to another place; but they are extremely cautious in the amount of work they do; they do extremely little. The working capacity is practically nil at that temperature, and the other day when the dry bulb was a little over 100° and the wet bulb was 85°, a man's rectal temperature was 102° after he had tried to do a little work.

3855. (*Professor Lorrain Smith.*) How long did that take?—He was in about 35 minutes.

3856. (*Chairman.*) Under the conditions of the weaving sheds, as far as we can make them clear to you, what would you fix as a reasonable minimum temperature as measured by the wet bulb?—I should agree with the limit which Dr. Haldane has fixed, about 70° to 75°. That exactly agrees also with some determinations of Rubner, who is one of the most eminent authorities in Germany on the subject.

3857. Where can we get that?—I have all these things in my epitome which will come to hand in due time.

3858. You also mentioned a book which you had written on the subject: that would be probably in the epitome?—I have not actually mentioned that article.

3859. We should tell you perhaps that under what was originally known as the Cotton Cloth Factories Act which has been embodied in the consolidated clauses of the Factory Act a standard of ventilation is laid down for humid cotton cloth factories. By a humid cotton cloth factory is meant a factory in which artificial humidity is introduced. The standard of ventilation as measured by the CO₂ is nine parts in 10,000. There are other sheds which in other respects are identically the same, only they are known as non-humid sheds. In non-humid sheds there is no artificial humidity introduced, but, of course, there is humidity which is got from respiration and perspiration. The more the ventilation is stopped up the more the humidity. Now can you form any opinion as to whether it is desirable that there should be a standard of ventilation in the non-humid sheds?—This is a question I believe of whether to have artificial humidity or, so to speak, natural humidity?

3860. I take it that the difficulty of having proper ventilation, as some people call it, in non-humid sheds is that on dry days, if you ventilate, the warp becomes so dry that there is difficulty in weaving; consequently moisture has to be got somewhere, and it is got by perspiration, respiration, and so on?—I believe the operatives prefer that method.

3861. I should say from the evidence we have heard that the operatives prefer only the CO₂ standard.

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The standard varies. This morning it was stated to be an average of 15, sometimes going up to 30, but we have not exact figures yet?—And in those sheds I suppose the wet bulb temperature is lower as a rule.

3862. (*Professor Lorrain Smith.*) Yes; we have to get that point confirmed?—The operatives very much prefer a lower wet bulb. They do not mind an excess of carbonic acid, and they dislike a high wet bulb. My opinion upon that point is that the operatives ought to have what they like. I would rather have an excess of carbonic acid than a high wet bulb temperature from the point of view of comfort. I do not believe any carbonic acid *per se* matters in the slightest whether it is 15, or 30 or 100 in 10,000—not *per se* as carbonic acid; it is not a poison in doses of that kind; it has no physiological effect except increasing slightly the depth of respiration, and is of no importance.

3863. (*Chairman.*) On the other hand, we have to bear in mind that after most careful consideration and after taking the very best advice that was to be had in the country, it has been considered the only practical way of arriving at some approximate idea of the impurities of the air in factories?—Yes.

3864. We have to work by that test?—Yes.

3865. No one has yet suggested any other practical method of doing it; consequently we have to work by that test. Now the point is this: This Committee does not want to lay down a standard which will greatly inconvenience operatives and add a considerable expense unless it is going to do good—that is, unless it is necessary for the health of the workers. Bearing in mind that we have to go by the CO₂ test what is a safe standard to recommend?—I should be quite ready to accept what has been suggested, 12 parts per 10,000. It is perfectly safe. I think the whole question is not one of carbonic acid, but carbonic acid is used as a test of other impurities—that is, other impurities and exhalations from unclean bodies and unclean clothes there is nothing poisonous exhaled; it only comes from clothes and bodies of men; and when Pettenkofer established the limit of carbonic acid as 7 parts in 10,000—I suppose that was 40 or 50 years ago—I should say that the bodies and clothes of operatives were far more unclean than they are now; and that a higher percentage of carbonic acid would now not render a closed chamber nearly so offensive as it was 40 or 50 years ago, because of the increased cleanliness and improved condition of the operatives, and I should say from that point of view the percentage might be allowed to be higher. Then with regard to the question of infection in a close atmosphere: the atmosphere is a moist atmosphere, and I suppose the walls and floors are moist in these weaving sheds, too, all of which must diminish infection from dust micro-organisms clearly; and with regard to other infection, I do not believe that diminishing the ventilation would make any difference. The experiments carried out by Buchner and Flügge are experiments on infection by spraying of tubercle, for example—the spraying of tubercle bacilli from the mouth during coughing and speaking—and other bacilli. It has been proved that bacilli are spread for very large distances—for many feet with a man speaking as I am now he sprays the bacilli from his mouth right through the whole room; and that kind of infection goes on whether ventilation is considerable or diminished in amount, and an ordinary contagion like the contagion of influenza is spread over the whole of the community in all our conditions, all our rooms, omnibuses, tramways, trains, and so on; the conditions are such that contagion is spread and we all get it who are not immune. Where you have a good stock, a stock which is immune to a particular disease, that is of infinitely more importance than the question of infection. I believe everybody must get the infection of an organism, but nearly everybody is immune to the organism; and from that point of view to diminish ventilation would not increase the risks from infection.

3866. (*Chairman.*) Another point has been brought before us by a great many witnesses: the introduction of steam or water in the form of spray. Some people say that impure moisture has been introduced into sheds, and that operatives have suffered in consequence. The law lays down that where you can get pure water from mains it is to be used. But there are

places where there are no mains, where you have to get the best supply you can, sometimes from a canal, sometimes from a river, sometimes from some stream and so on. Could you suggest to us any standard of purity for the water to be used for such purposes? I may mention that one has been suggested—as a matter of fact it is enforced by law in flax mills in Ireland. But if you are not prepared to give us your own opinion, I would submit this one and ask your opinion upon it.—A standard of quality of water used for steam?

3867. For steaming?—I am not prepared to give a standard for that. I should not have thought it was a matter of much importance at first sight.

3868. A great deal of importance is attached to it by the operatives.

3869. (*Professor Lorrain Smith.*) They say they can detect it at once.

3870. (*Chairman.*) I may say there is only one standard of ventilation throughout the Factory Acts. I will read this to you, but this is not in the Act itself, but there are powers to make special regulations for dangerous trades, and after certain formalities and proceedings have been gone through they have the force of law. This is for the flax trade; that is the wet spinning of flax, and it has the force of law—"No water shall be used for producing humidity in the air or in wet spinning troughs which is liable to cause injury to the health of the persons employed, or to yield effluvia, and for the purpose of this regulation any water which absorbs from acid solution of permanganate of potash in four hours at 60° more than 0.5 grain of oxygen per gallon of water shall be deemed to be liable to cause injury to the health of the persons employed." I daresay it would be difficult to express an opinion right off upon that?—I could not express an opinion.

3871. If we sent you that regulation would you consider it?—Purity of water is a thing outside my opinion; it is a new problem altogether. Making the air moist by steaming I think is a very inferior method. If it could be done by evaporation it would be very much better.

3872. Or by atomising water: water is atomised so very fine that you could hardly tell by looking at it that it is not steam, it is so fine?—Steam must tend to warm the air.

3873-4. (*Professor Lorrain Smith.*) Can you tell us anything about the method of evaporation that is used in large rooms?—I have no practical experience, but one can imagine that that would be very much the better to pass the air over a large surface where it would be cooled by evaporation so as to keep the wet bulb down as low as possible. When steam is used the air must be much wetter. It comes in warm, and in a great state of condensation; it must wet the clothes very much more than air rendered humid by evaporation. If you could get the wet bulb below the outside temperature of the clothes and yet get the air sufficiently humid, that would seem to me to be the thing. If you could keep the external wet bulb temperature below that of the air entangled in the clothes, the clothes would remain dry.

3875. Do not you get clothes wet by perspiration?—If you keep a few degrees of difference it would be an advantage in promoting perspiration.

3876. You must have a sufficient amount of humidity?—I understand that 65° is sufficient. A wet bulb of 65° would do.

3877. (*Mr. Roberts.*) It is a question of relative humidity. Relative humidity keeps you near the saturation point at any temperature. The best temperatures are about 70° dry, but you must have a certain relative humidity for the weaving.—The body can get rid of its water by using the body temperature. It has got an enormous advantage; it saturates the air at almost body temperature.

3878. (*Professor Lorrain Smith.*) No doubt; but you are nearly always up to 80° or over 80° if the temperature of the shed is good?—Then you cannot get it at a temperature that suits.

3879. You cannot weave unless you have the relative humidity. The best results are got with 85 and 88

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per cent. That leaves you little margin?—If you get your 80 per cent. with a low external temperature—

3880. No, you must have a temperature of 70° or about that; then the fibre seems to work best. You have two conditions to look at, both temperature and moisture, and it is a question of relative humidity?—From the point of view of the operatives the whole thing is to keep wet and dry bulb down at 70° if you can do it.

3881. That is why I asked you if you had had any experience of the cooling?—As to how far it would be cooled, no.

3882. Generally speaking, the moisture in the air is a much more deleterious element in a badly ventilated room than the CO₂?—Yes, certainly, if the temperature of the room is high.

3883. It has been suggested to us that a good way of estimating the insufficiency of ventilation or the improper condition of the atmosphere would be to take direct measurement of the moisture by the wet bulb, that that would be a better way than the CO₂ test, or that at least it ought to be combined with the CO₂ test?—Yes, the wet bulb temperature should be watched more carefully than the CO₂ for the comfort of the operatives, and that will lead to their health; and this is not a question of death statistics at all: it is a question of comfort. It does not matter how long a man lives if he is uncomfortable the whole of his life. It seems to me it is a question of comfort; and that it cannot be settled by death statistics at all.

3884. Of course, we have that in view, that long before you come to these temperatures and humidities it would cause heat stroke, and you go through the stage of bodily discomfort?—Yes, undoubtedly.

3885. And part of our inquiry is to discover at what temperature that arises, or rather at what temperature combined with humidity, and 75° wet bulb is given as a maximum limit by several witnesses. I think you agree with that?—I quite agree with that for work. Of course, you can work at higher wet bulb temperatures, and in practice it seems to make a difference. In the St. Gothard Tunnel they had a wet bulb of 31° C. at times saturated.

3886. Had they a current there?—Yes, they had a current.

3887. Were they stripped?—Yes, and they suffered a great deal. They did get a certain amount of immunity after a time. Staff, who recorded it, said that they could stand more by 2° Centigrade than he could without having their body temperature raised.

3888. By practice they get into the way of avoiding exercises which would cause a rise?—I should think it is more than that.

3889. It has been represented to us that the miners get the knack of being skilfully idle?—It is not only that. The other day I put that breathing apparatus on a very powerful man. In two hours he did 340,000 ft. lbs. of work, so he was a powerful fellow. He went in with a weak student who had been a mining student but had changed over to medicine. The two went in, but the mining student came out long before the other man, and his temperature reached 102° long before the other man's did. I should think the circulation makes a great deal of difference in sending the blood at far greater velocity through the skin and increasing the loss of heat.

3890. There is a very great difference in the ability to perspire?—There is a very great difference in the ability to perspire too. It was very interesting to watch the skin temperature rise. A man's skin temperature goes up like a wet bulb thermometer goes up; I was watching it yesterday. I started with a skin temperature of 93° F. and I ended up with a skin temperature when I was in the hot chamber of just over 100° under my shirt, though I was sweating freely.

3891. There is one other point I have to ask you about. It has been suggested by observers that working in these hot atmospheres, although it has no immediate pathological effect wears a person out; persons become old earlier in life than they would otherwise?—I do not know anything about that. I know as far as caisson workers go they work in high tempera-

tures frequently and in an atmosphere that is saturated with water to 80 or 90 per cent.

3892. With no ventilation?—Not much.

3893. And no current?—No current and temperatures ranging up to 25° C. at the Nussdorff caisson works, where the men were fully examined for months by Schrotter. These men did not lose weight at all, and they had no loss in red corpuscles or hæmaglobin in the blood. As far as all these observations went there was no deterioration in their health, but they had a particular pale kind of face which is very peculiar—I refer to these compressed air workers—and that may be simply associated with underground work.

3894. (Chairman.) Did these caisson workers work right through the week?—Yes.

3895. How many hours a day?—Four to eight hours shift; an eight hours shift is quite common at moderate pressures.

3896. Is their work of a continuous nature?—While they are in the tunnel you mean?

3897. Yes?—Yes, the hardest labour. They work well.

3898. Do they take on a job for perhaps six months and then go to other work for some time?—Some of them go from caisson to caisson. There is a regular set of men who keep at it for a great number of years.

3899. Do not they inhale oxygen in some form or another?—They get a high pressure of oxygen; that is of no moment whatever.

3900. Would not that help to prevent them losing their health?—I do not think so. There is no evidence of that. Oxygen, as Dr. Lorrain Smith himself has shown up to a pressure of 80 per cent. of an atmosphere, does not have any effect.

3901. Then why is it introduced?—It does if you cannot get enough, if your circulation is failing, and in anæmia. But excess of oxygen does not have any influence on the metabolism of the body until you get up to a very high percentage, and then it diminishes.

3902. When this oxygen has been introduced is the air they breathe approximately the same as the normal condition of the air?—It has the same percentage composition. It is simply atmospheric air forced in at a pressure of one, two, or three atmospheres.

3903. But as to the relative components?—They are exactly the same except in the matter of carbonic acid. The carbonic acid goes up to 0.3, often to 0.5 per cent., and then you have it multiplied by the atmospheres; you would have a partial pressure of 0.9 to 1.5 per cent. of an atmosphere at plus 30 lbs. pressure—equal to 150 per 10,000.

3904. Has that any particular effect?—None at all.

3905. Is not there a disease called caisson disease?—This is caused by the escape of bubbles of nitrogen in the body fluids from coming out too quickly?—Actual working in compressed air does not do any harm at all. I have been in compressed air myself up to 75 lbs., and allowed the carbonic acid to reach a partial pressure, equal to 150 parts in 10,000, for hours. My colleague, Mr. Greenwood, went up to 92 lbs.

3906. (Mr. Roberts.) Dr. Hill, you do not pay very particular attention to the CO₂ question in weaving sheds?—No, if the operatives like to have the shed shut up, and get their moisture in that way, with a higher percentage of carbonic acid I should let them do it.

3907. On the hot summer days that we may have with a sun temperature possibly of from 95° to 100° beating down on the shed roof, and with an artificial humidity inside being got by live steam, as we term it, with a plenum system of ventilation, under those circumstances we get over 75° wet bulb on hot days, and even occasionally as high as 80°; and if we were to shut off the humidity and stop our fans we should thereby, of course, reduce the temperature probably, but we should increase the CO₂, and according to your statements we should have no unhealthy conditions?—I think the conditions, if you could lower the wet bulb temperature, would be much better.

3908. It would lower it on those days, I think?—Could not you have a canvas over the roof with an air

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space between, like they have in the Persian Gulf on board the men-of-war?

3909. Our shed roofs are of very large area?—Then a shop-front kind of thing is impossible.

3910. It is impossible. I could not give you the area of a shed, but we do whiten the slates and the windows to keep down the temperature as far as possible. But what I wish thoroughly to grasp is this point: that the matter of a few volumes of CO_2 is quite immaterial?—Quite. It is only an indication of other things in the air given off from unclean bodies and clothes, the deleterious effects of which have never been proved. They are unpleasant, and to a neurotic person, a person of high culture, they may be particularly unpleasant, but they may not be unpleasant to other people. I think by far the largest part of the population likes to get into a room and stew in a condition of heat, and the animals like that. I do not believe in this low percentage of CO_2 .

3911. We must not exceed nine volumes by law, and in actual practice we are allowed five volumes over the outside air, whatever it may be?—Fresh air and open air is stimulating and healthy, giving an increased circulation and that kind of thing, but that can be got outside the hours of work. If you must have a humid air, then get it with a low wet bulb; a high wet bulb is an extremely uncomfortable and miserable thing to stand. An excess of carbonic acid and air that is more or less stuffy is not unpleasant to stand to most of us. We do not notice it.

3912. We are to get a low wet bulb even if we have to have CO_2 ?—Certainly.

3913. (Mr. Higson.) Is not a high percentage of CO_2 an indication of the atmosphere being more or less injurious to the people?—Well, as I have tried to say just now, it is a question of unpleasant exhalations which make the air smell, which has a nervous effect on people. It has never been proved that it has any other or a poisonous effect. The ordinary effect that we all of us get on going into a crowded room I believe is chiefly due to the high wet bulb temperature, and inability to keep down the body temperature, and it is due also to the excessive lighting and excitement, and so on. I do not believe it is due to bad ventilation and bad air.

3914. You speak of the low wet bulb. You know we have to regulate our wet bulb by the dry bulb. We have not to exceed a certain percentage. How is it possible to maintain a low wet bulb, say, on a hot day, and give our conditions for weaving? Suppose we get 80° dry bulb, and the Act allows us 75.5° I suppose you would come down to 68° or 65° and you would call that a low wet bulb?—Yes.

3915. Supposing it came down to that it would be such a condition that would not be very good to work in, that is to say, the material would not work as it ought. Of course, we all agree that a low wet bulb is a most desirable thing, but a wet bulb relatively in comparison to the dry bulb is necessary for us to work with?—Yes.

3916. How would you maintain a low wet bulb?—Only by keeping down the dry bulb. The question is can it be done by this method of evaporation which Haldane has proposed.

3917. (Mr. Hartley.) That is the evaporation of water?—Yes, leading the air over wet screens, cooling the air by evaporation. (Chairman.) Such for instance as the Hart system.

3918. (Mr. Hartley.) You are raising the wet bulb by doing that or increasing the humidity at any rate? You increase the humidity.

3919. That is what is objected to by the operatives?—They would not feel it if the temperature is low. If you cool it at the same time they will not feel it. Then the question arises how far can you cool it. I do not know how far it can be cooled by evaporation.

3920. You were speaking about something that might be put over the roof of the building similar to what is put on ships: do not we get the same result by whitewashing the roof. The slates are perfectly cool: I have felt them many a time, and the windows too. They are perfectly cool on the hottest day when covered with a good coating of whitewash. Can we do

more than that?—I think you would find it much more effectual to have an air space between. If you had a white surface which would reflect the rays away in space, then with an air space between it would be a splendid non-conductor.

3921. I follow that idea, but I do not see how the heat is going to pass into the room below if it is not present on the roof outside. I think my colleagues, who are manufacturers, will tell you that wherever you efficiently whitewash the slates they are cool. It is Welsh slate, mostly blue slate, and when that is whitewashed and the window also they are perfectly cool to touch. I do not know whether Mr. Thomas has noticed that, but I have certainly many a time?—An enormous lot of heat goes in through the skylight. That heat is trapped; it is like a greenhouse.

3922. (Chairman.) Certain rays will pass in and will pass out. The obscure rays will not pass out, and so you keep all your heat in?—That is so. All the light rays go in. They are all trapped. They get in and are absorbed by the floor and the operatives and everything else, they are given off again as heat rays, and they cannot get out through the moist wet atmosphere.

3923. (Mr. Thomas.) Do I understand you have never been inside one of these sheds?—No, I wish I had.

3924. You cannot say from anything you have heard as to what really ought to be the highest temperature in which these people work because you have never seen them work?—No, but from observations I have made myself I should say it is most uncomfortable to work under conditions where the wet bulb rises above 75° . Up to 75° would be bearable.

3925. Irrespective of the relative humidity?—Quite.

3926. Even if the dry bulb were 76° ?—It does not matter what the dry bulb is; if the wet bulb is at 75° it is uncomfortable to work.

3927. You said you were not surprised that the operatives in dry weaving sheds preferred more CO_2 ?—Yes.

3928. Take a case like this. Here you have a humid shed at about 72° dry, 69° wet, and 8 or 9 volumes CO_2 in 10,000. Take a dry shed with the dry bulb at 72° and the wet bulb at 64° and 15 or 20 volumes of CO_2 per 10,000: that complies with the law?—I would much rather have the latter condition 64° wet bulb, 72° dry, and 15 volumes of carbonic acid if I were an operative, than I would have 69° wet bulb, 72° dry bulb and 8 to 9 carbonic acid.

3929. (Mr. Hartley.) That is where I am afraid we are going to get confused. It is assumed that 15 volumes will be found to be a practicable standard. (Mr. Roberts.) The illustration was 18. (Mr. Hartley.) That fifteen volumes has been found to be a practicable standard for a dry shed, is the assumption. I come from a district where they are all dry sheds. I dispute that entirely. You cannot keep it at that with the conditions under which the weaving industry can be carried on.

3930. (Mr. Thomas.) Suppose we carry that further. Assume the first case again, and take the second case to be 72° dry and 64° wet, and 25 volumes of CO_2 per 10,000, what is your opinion then—are we getting too far?—I should say that the excess of carbonic acid was preferable to a high wet bulb.

3931. (Mr. Hartley.) Even at 25 volumes?—Even at 25 volumes.

3932. (Mr. Thomas.) Have you any limit to that?—No, we have no data to go upon; we should have to watch it, but I believe with the improved conditions of food and the generally improving conditions of life of to-day that the low death statistics are due to those things, and that it was not the old conditions of imperfect ventilation which produced high death statistics in the past. That is what I should say. We should have to watch it carefully supposing this were permitted.

3933. You have to remember that these people stand ten hours a day in the sheds or 55 hours per week; some more. It is a long time—you recognise that in giving your answer?—Yes. You know it is a question which you would rather have. They are both bad. One does not want either. You are on the horns of a

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dilemma. Which are you going to have: unpleasant smelling air or a high wet bulb.

3934. (*Chairman.*) You will not say anything beyond 25 volumes?—I do not know. Those caisson workers work in 100. If the air were not noticeably unpleasant to smell I should not mind going up to 100 volumes. I do not mind what the carbonic acid goes up to as long as the air is not unpleasant from other causes. At the same time moist air is excellent for keeping down infection. There is one point I have not mentioned: that you have bad air if you diminish the ventilation, but if you increase your wet bulb you lower the oxidation of the body—I mean the hotter the conditions are the less will be the heat production as long as you do not overheat the body. If you overheat the body it will become febrile. If you do not, the amount of respiratory exchange will go down, the amount of oxygen taken in and carbonic acid given out will both be diminished, so you reduce the activity of the chemical exchange in the body by your high temperature.

3935. (*Mr. Hartley.*) Then this point, Doctor: in very hot weather in dry sheds, that is where there is no infusion of steam at all, there is certainly a considerable amount of oppression?—Yes.

3936. Especially in the afternoon. We notice then by ventilation we relieve that very considerably. How does that come about?—You increase the ventilation?

3937. Yes. We will say there is none in the morning part?—You throw the windows open?

3938. No, we have mechanically propelled fans, the ordinary plenum system, and we have the greatest difficulty in keeping them running; that is, the operatives themselves will stop them if they can get the opportunity. In the afternoon sometimes we have had to insist upon having them working, because we saw that the operatives were getting fagged with the work. Would that be because there was too much CO₂, or would it be the heat or would it be too much humidity?—I should say it was the heat due to the humidity and the high temperature, and that the current of air cooled the bodies of the operatives effectively. Have you observations of the wet bulb?

The witness withdrew.

Mr. ALFRED T. WALKER (with Mr. SAMUEL STONES), called and examined.

3946. (*Chairman.*) Are you the proprietor of the Cradwell Mill, Blackburn?—The managing director.

3947. Who is the gentleman with you?—Mr. Stones, manager of the same mill.

3948. We visited your works, did not we?—Yes.

3949. And you have both humid and non-humid sheds?—Yes.

3950. And the non-humid shed, I think, is kept cool in rather an exceptional way?—Yes, I think so.

3951. Would you describe that?—We have a concrete roof with water on it.

3952. (*Mr. Hartley.*) A flat roof?—Yes, a flat roof.

3953. Where do you get your light?—The windows are raised just like garden lights.

3954. (*Chairman.*) How many sheds have you altogether?—Seven of one sort and another, but not in the Cardwell Mill; we have only two there.

3955. We will confine our remarks to the Cardwell Mill first?—Two sheds.

3956. One is humid and the other is not?—The other is non-humid.

3957. You are working that system at present?—Yes.

3958. Are the same goods produced in both sheds?—Yes.

3959. Is the sizing the same?—Exactly.

3960. Identical?—Identically the same.

3961. Both with regard to composition and to amount?—Yes.

3939. We have?—What do you find the wet bulb?

3940. That I do not know. We have been keeping records of observations for twelve months?—I should say that was entirely due to extra heat which occurred in the summer time. The fagged appearance of the workers is a wet bulb question entirely, I should say.

3941. Through the cooler months of the year there is no desire for any ventilation in the dry sheds I am connected with. There is a positive objection on the part of the operatives to it, but when the sun becomes powerful, say in June and onwards, we find then that there is not only not that objection on the part of the operatives, but it is beneficial to them to have the fans working, and that it does seem to remove that fagged look and the oppression they seem to suffer from, even although the outside air is as hot as it is inside the shed. My point is, what is the reason that it has that beneficial result?—It is due to the current of air increasing the heat loss I should say entirely; you have your clothes on; you have air entangled in the clothes at a temperature, let us say, of 93° F., and outside the temperature is 80°. You get a current established; the currents at 80° will blow away the hot air at 93° out of the clothes.

3942. I am assuming that the heat is the same outside the place as inside?—Supposing it is all at 80° outside and inside, it is 93° in the interstices of the clothes, and the air at 80° will drive out the air at 93° and take its place, and will so increase the heat loss.

3943. (*Mr. Thomas.*) You say the CO₂ has nothing to do with it?—No.

3944. (*Professor Lorrain Smith.*) You are introducing relatively dry air?—Relatively dry air, and you bring in air which is drier and cooler than that which is in the interstices of the clothes.

3945. (*Mr. Hartley.*) It does not necessarily follow that the heavy atmosphere and oppression they were feeling is due to the excessive amount of CO₂?—I do not believe it has anything whatever to do with it. It has nothing at all to do with it. It is purely a question of temperature and keeping down the CO₂ to these low limits is absurd under these conditions.

3962. How long has this gone on?—About two years for the new shed: that is the humified shed. That was built just two years.

(*Mr. Stones.*) That was built just two years; the other was 1878.

3963. Can you tell us what the comparative results have been with regard to output?—There is very little difference in them.

3964. Have you handed in a statement?—Yes.

3965. (*Mr. Hartley.*) Which is the dry shed?—The old shed is the one we have called a dry shed.

3966. (*Chairman.*) Would you in your own words just tell us the comparative results, or would you like to refer to your statement?—I think there is very little difference in it, but the old non-humid shed is just a trifle better.

3967. With regard to output?—Yes.

3968. (*Mr. Roberts.*) Can that be put in a percentage?—It is only part of a penny.

3969. (*Chairman.*) What system of humidifying have you?—Vortex humidifiers and steam jets as well.

3970. Have you any statistics showing the relative humidity in the two sheds?—Yes, I can give you both. I can give you a statement which shows it better than the one you have.

3971. Will you just explain it, and the shorthand writer will take it down. Give us the average results?—The non-humidified shed averaged 74 per cent.

3972. Between what periods?—There are the hottest days between May 13th and October 1st last year.

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3973. And the average was what?—74 per cent.

3974. Of relative humidity?—Of relative humidity in the non-humid shed and 76·5 per cent. in the humid shed.

3975. (Mr. Thomas.) For the same period?—The same period.

3976. (Professor Lorrain Smith.) They are practically identical?—There is $2\frac{1}{2}$ per cent. difference.

3977. That would be inappreciable?—Yes, it is inappreciable. I also have the figures, if they are of any service to you, for the other sheds where there are different systems of humidifying and ventilation. This statement gives the outside temperatures as well on the same day together with the percentages.

3978. So far we have only dealt with two sheds?—Yes.

3979. That is the humid shed and the non-humid shed. The particulars so far relate to those two?—Yes.

3980. Then what is this we are dealing with?—That adds the other sheds to this list.

3981. Where are these other sheds situate?—Two in Blackburn, and one at School Lane near Preston.

3982. We are dealing now, then, with some other sheds?—Yes.

3983. What are the names?—The Highfield Shed and Witton Shed at Blackburn, and Stone Mill at School Lane, near Preston.

3984. The Highfield Shed we will take first. That is a humidified shed?—Yes, with steam jets, and with exhaust fans.

3985. And the average relative humidity for the period stated is what?—72·5 per cent.

3986. The next shed we deal with is the Witton Shed?—Yes.

3987. How is that ventilated?—Hart's fans and machines: Hart's humidifiers really we call them.

3988. What machines?—Hart's, and steam jets as well.

3989. Five Hart's humidifiers?—Yes, and steam jets. There are a few steam jets.

3990. And the relative humidity there is what?—73 per cent.

3991. Now come to School Lane?—That is humidified with Parsons' apparatus and one exhaust fan.

3992. And what is the relative humidity?—68 per cent.

3993. Now shall we take the highest reading of the wet bulb for each of the sheds? Perhaps there will not be a wet bulb?—Yes, we have both dry and wet bulbs.

3994. This is the non-humidified shed: what is the highest wet bulb?—79·5.

3995. On what date?—On July 18th.

3996. (Mr. Roberts.) In what year?—Last year.

3997. (Professor Lorrain Smith.) 79·5 per cent?—No, 79·5° temperature, wet bulb.

3998. (Chairman.) Now take the Cardwell Mill?—Do you want the same day?

3999. No, I want the highest reading?—It was on the same day, 73·5°.

4000. That is in the humidified shed?—That is in the humidified shed.

4001. Now the Highfield Mill?—That is 82·5.

4002. On what day?—The same day.

4003. Now the Witton Mill?—That is 82° on the same day.

4004. The highest?—Yes, the highest.

4005. Now the School Lane Mill?—School Lane is 83° on the 17th July.

4006. Those are the highest readings?—Yes, and I can give you the percentages on the same day, if you like.

4007. (Mr. Hartley.) We just now had the wet bulb on the 18th of July in the dry shed. What was the dry bulb on that day?—85°.

4008. (Chairman.) These tables will be handed in for reference. Coming to the question of the health of the workers, those who work in humid and non-humid sheds in the Cardwell Mill, can you tell us anything or have you any statistics that would enable us to form any opinion?—They are on this list. The humidified shed is a very small shed, and the ground covered in these statistics is not very extensive.

4009. What is the size?—They are only 80 looms. It is only just a bay that was boarded off on the request of Mr. Rogers, the Inspector—that is the humidified shed.

4010. Have you any percentages?—Yes, they are in different periods from May 13th, 1905, to October 6th, 1906.

(Mr. Stones.) During that period they were both non-humidified.

4011. (Witness.) 0·54 workpeople off daily. If one person is off ten days it is called ten people off one day.

4012. (Chairman.) Are we right, that they are both humid at that time?—At that time they were both dry sheds. In this period the two sheds are split up into the non-ventilated, non-humid shed, and the humid shed. At this period it was a dry period; the Vortex was not running. It was split up differently.

4013. (Professor Lorrain Smith.) The new shed was yet not humidified?—Not humidified. It was not ventilated at this period.

4014. (Chairman.) Tell us when you began to make the difference?—0·032 per cent—the next period is from October 6th, 1906, to March 27th, 1907, the non-humidified shed.

4015. Is there a difference now?—One is ventilated and non-humidified, and the other is non-ventilated and non-humidified—0·08.

4016. (Mr. Higson.) That is in the non-humid shed?—The non-humid non-ventilated shed. The other shed is non-humidified but ventilated. The tables were kept in this form on Mr. Rogers' suggestion—0·07. The next period is where a humid shed is humidified with steam jets and ventilated. The humid shed is 0·043 per cent. The non-humid is 0·08. The next period is when the humid shed is ventilated and humidified with the Vortex system.

4017. (Professor Lorrain Smith.) With steam jets?—No, not steam jets, just the Vortex. 0·09 per cent. The dry shed, that is the non-humidified shed, is 0·05; and the last one is under the same conditions but in winter time, in cold weather, if that is of any interest to you. In the cold weather the sickness in the humid shed is 0·09 and the old shed the same exactly. They work out to the same thing.

4018. (Chairman.) Now will you take the CO₂?—I have no tests except what you gentlemen have. Mr. Rogers took them. Professor Haldane took them and a gentleman, I think his name was something like Pendock, along with Mr. Osborne.

(Mr. Stones.) I have them handy if you would like them read out.

4019. (Chairman.) Thank you. It would be interesting to know the amount of CO₂?—I believe the CO₂ is very very bad in the old shed. I can give you the sickness percentage in some of these other sheds as well that are ventilated and humidified.

4020. (Mr. Hartley.) What is the size of these dry sheds: how many looms?—516.

(Mr. Stones.) All this relates to our shed, all the way down. That is in 1902. (Producing table.)

4021. (Chairman.) Which shed is it?—(Mr. Stones.) We had only one shed then.

4022. (Chairman.) This is the first report of the Departmental Committee to inquire into the ventilation of factories and workshops. That was Mr. Haldane's Committee. The proportions are varying from about 22·8 and run up as high in some instances as 46 or 47 parts; 22·8 seems to be the lowest. Do you know or can you say approximately if it is about the same now?—I can give it to you just recently.

4023. (Mr. Hartley.) Mr. Chairman, I think what we really want is to get the CO₂ tests at the period covered by these other tests.

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Mr. A. T. WALKER.

(*Witness.*) I can give it to you on the 23rd of May, 1906; that is in this period. That period begins in 1905 and comes up to last Christmas.

4024. May 13th was in 1905?—Yes.

4025. Have you the CO₂ test for that time?—No, but I have the CO₂ for the 23rd of May in the year following that, 1906.

(*Mr. Stones.*) Under the same conditions?

(*Witness.*) Under the same conditions in the dry shed; the old shed, 34.1, 41.6, 34.6.

4026. (*Mr. Hartley.*) It would be useful to us to know. We get from this list the relative humidity in this mill on those dates, but we want to know whether that is due to abnormal presence of CO₂ or not.

4027. (*Chairman.*) It would be useful, but I am afraid I do not see how we can get it. This gentleman made no CO₂ tests.

(*Witness.*) We can take any day now under exactly the same conditions.

4028. (*Chairman.*) However, if you did not take CO₂ tests for yourselves you can only get information when the inspector happens to have gone, which may have been only once or twice a year. I suppose that is the inspector's test you are giving us now?—Yes.

4029. (*Chairman.*) In the recess or now the secretary could go and take some tests?

4030. (*Mr. Hartley.*) The part we require is No. 4 in the Terms of Reference. We have to inquire what special arrangements (if any) are necessary in order to admit of the proper ventilation of dry weaving sheds without prejudice to the process of manufacture. According to this return there is no prejudice to the process of manufacture when you are getting humidity such as is shown. To go a step further, we want to know what was the condition of the atmosphere as ascertained by the CO₂ test, and we have not got that information.

4031. (*Chairman.*) I am afraid we have not, and I do not see how it could possibly be got.

(*Witness.*) We can give it for certain dates under precisely the same conditions. That shed is not ventilated, and never has been.

(*Mr. Hartley.*) We want the humidity readings at the same time.

(*Mr. Roberts.*) They can be got exactly as the witness suggests. On the days when these CO₂ tests were taken, undoubtedly Mr. Walker will have the readings of the hygrometer.

(*Chairman.*) After all said and done, it is only one or two days—that is all we can get, and we are proposing to do something better than that. We have an instrument now which will enable us to go into a shed, and in five minutes see exactly what the amount of humidity is, and we are also proposing to take several CO₂ tests as well, so we shall get the condition of the mills in that way.

4032. (*Mr. Thomas.*) In connection with these tables, may I ask this. You have the outside temperature marked here. Would you mind telling us how this was taken, and where you got it from?—The outside temperature was the School Lane temperature.

4033. You took it yourself?—It was taken by the clerks in the ordinary way.

4034. In the yard?—In the mill yard. We keep a register of that every day.

4035. (*Mr. Hartley.*) The hottest day was given as July 18th?—The hottest day inside the shed.

4036. 85°, inside 9° hotter. Of course, this is a concrete roof?—At Cardwell Mill. The non-humid shed has a concrete roof. There are no fans; no ventilation, no ventilators, or, rather, there have been ventilators, but they have been stopped up.

4037. Have you found any preference on the part of the operatives, which shed they would work in?—They preferred working in the dry shed.

(*Mr. Stones.*) I asked one of them on Monday: "You have had a winter in this shed, which do you prefer?" He said: If you do not let me go back into the other shed I shall give notice and leave after the summer.

4038. (*Chairman.*) Which shed was he in?

(*Mr. Stones.*) The humidified shed. He wants to go back into the other.

(*Witness.*) The reason given is draughts chiefly.

(*Mr. Stones.*) He said there is more work. That is what he said to me.

4039. (*Chairman.*) More work in the humidified shed?

(*Mr. Stones.*) Yes.

4040. (*Professor Lorrain Smith.*) The thread snaps more frequently?—Yes.

4041. (*Mr. Hartley.*) You have a larger percentage of humidity in the dry shed than you have in the humidified shed?—Yes.

4042. What is the reason for that—is there something in the subsoil?—I do not think there is anything in that. I think it is simply the still air and people's breath, and that sort of thing. They breathe it over and over again.

4043. (*Mr. Roberts.*) It becomes humidified, as explained by the Doctor?—You see it gathered on the girders and beams in beads.

4044. (*Mr. Thomas.*) With regard to the little shed, the humidified shed, it will be an ordinary shed roof?—No, it is a concrete roof. It was built as an extension of the old shed. Then Mr. Rogers came and asked us to board this part off, and ventilate it and humidify it. One shed is ventilated and the other is not.

4045. What about the production?—It is identical. The breakages are rather less in the old shed than in the new.

4046. In the dry shed?—Yes.

4047. The breakages are more numerous in the dry shed?

4048. (*Chairman.*) No, the other way about.

(*Witness.*) In the humid shed the breakages are more numerous.

4049. (*Professor Lorrain Smith.*) Everything is upside down. The expression of opinion is that they prefer to go into the dry shed out of the wet shed?—I think it is prejudice more than anything. On the hottest day in summer I went in along with Ainsworth, and one of these men was a notorious grumbler and was grumbling about this new shed, and the remark was made to him, "You look comfortable." It suddenly struck him that he was not perspiring, and yet other people were who were in the dry shed. Now I may tell you that under the School Lane conditions, where the roof is of ordinary slate and glass, and humidified with Parsons' humidifier, where there is the same cotton and the same size, the breakages are still fewer than in the dry shed at Blackburn, and there is more production got out and better work.

4050. (*Chairman.*) The same warp and weft?—The same exactly in both instances.

4051. (*Mr. Hartley.*) Mr. Chairman, we shall have to get a new name for these sheds. The dry shed is more humid than the one that is humidified.

(*Witness.*) We have often found that. I proposed to Mr. Rogers that he should allow us to run a little beyond the Act in the humid shed to let him have a test for sickness in that shed, but we got sat upon. We always keep these statistics, amongst a lot of others, for our own information.

(*Mr. Roberts.*) This is one of the most interesting cases we have come across.

The witness withdrew.

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Mr. JOHN HOLDEN, called and examined.

4052. (*Chairman.*) You are the occupier of a cotton cloth factory, are you not?—Yes.

4053. What is the name of the mill?—I have two mills; one is the Hindle Street Mill, and one is Prospect Mill.

4054. Situate at —?—They are practically both in one line, in one street.

4055. In what town?—In Darwen.

4056. Are they humidified mills, or not?—Both.

4057. Is there humidity in one and not in the other?—They are both humidified.

4058. And in the Hindle Street Mill I understand there are 510 looms?—Yes.

4059. And not more than 5 per cent. of size?—That is it.

4060. You have nine $\frac{1}{4}$ -inch steam jets?—Yes.

4061. And eight fans for the out-take?—Yes.

4062. In the Prospect Mill there are 320 looms, and you use about 5 per cent. of size?—Yes.

4063. And what system of ventilation?—Five exhaust fans.

4064. And you have in the Prospect Mill 18 steam jets?—Eighteen $\frac{1}{2}$ -inch, I think they are there.

4065. It is $\frac{1}{4}$ -inch in the statement?—I am not sure about the size.

4066. In the Hindle Street Mill you had a breakdown with your humidifying plant, I understand?—Yes, it was a case of a plug trap which got choked up, so that we could not get any steam through.

4067. That was in the early part of 1907?—Yes, last year, January and February—about then.

4068. How long did that last?—It was a diminishing quantity so far as the amount of steam we could get in, because the orifice in the tap kept growing less; it was just choked up with dirt; and the amount of steam we could get into the shed was lessening day by day.

4070. For how long, for a month or a year?—I do not know how long it had been going on. When I was told about it there was just a breath coming out of the jets, nothing more.

4071. The statement here says that it began early in 1907?—Yes.

4072. Approximately, how long did it go on?—Perhaps three months.

4073. And what was the result on the output?—Well, I can hardly speak as to that, because I do not know whether all the looms were going or not just at the time. It is very likely they would be. I know there was a general outcry about the quality of the material, and that sort of thing.

4074. From whom?—From the workpeople.

4075. The workpeople said that the quality of the material turned out was inferior?—No, the quality of the material that was given to them to work was bad. A deputation, in fact nearly all the weavers, came to complain about bad material. I said it was during a spell of weather that was about the worst kind of weather imaginable for weaving purposes, and I asked the question whether they were sure it was bad material or bad weather that was causing all the trouble. I said so far as the material was concerned I was not at all satisfied with it myself, but it was as good as I could get.

4076. Was the material inferior to what you generally supplied to them?—I think it was to some degree, but I could not tell to what extent. They said they thought they would do better if they could have more steam.

4077. That was owing to the fact that you were using worse material; it was not the normal state of things in your works?—No, not exactly, but one could hardly test the thing so far as material was concerned, because they had less steam, and in consequence of

having less steam the material, even if it were better, would work worse.

4078. I am afraid no one can tell us as to the material but yourself; we can form no opinion, and unless we know whether the material was inferior to what you generally use we can form no conclusion at all?—Perhaps it was a little bit worse than usual.

4079. And consequently the men asked for some more steam?—They asked for some more steam; they had not been getting the normal quantity of steam.

4080. I understand that in the Prospect Mill, at Darwen, you tried for some time to do away with steaming altogether?—Yes.

4081. Why did you do that?—I did that because of the general outcry throughout the county on the question of steaming. I thought, I will not go to any expense in putting in any sort of humidifying apparatus till there is something settled with regard to the matter.

4082. But as a matter of fact you are now using steam; is that so?—Yes, I durst not winter without it.

4083. How long did you run without?—Close up to November I should say—October or November from June.

4084. From June to October or November you ran without steam?—Yes.

4085. Then why did you put steam on?—I put steam on because the workpeople asked for it.

4086. Did they come as a deputation or did somebody come representing all the workers, or was it some individual who asked?—Different individuals at different times. They did not come as a deputation. There was first one and then another saying: "Why do not you give us some steam?"

4087. And you gave it to them?—I gave them steam.

4088. Are they satisfied now; do they like it now they have got it?—Well, they do not grumble. They would grumble if I took it out, I know.

4089. (*Mr. Roberts.*) I suppose, Mr. Holden, you wish the Committee to understand that had you not put steam into these two sheds your weavers would have caused you trouble?—I am certain about it.

4090. In the first shed, the Hindle Street Mill, when this plug tap got made up, if you had not done something they would have come into the street; they would have struck work?—I think they would. The first thing I did after I had seen the deputation of nearly all the workpeople was to send them back again. I was afraid of the engine running away and causing damage. The first thing I did was to tell the engineer at noon to run the engine slower. That was the first step. I had forgotten that the five exhaust fans that had been put in that shed during the Fair week (that is in July the year before) had no automatic doors in for closing when the engine was stopped. The consequence was that for fourteen hours out of the twenty-four the wind was blowing down those fans a sort of back draught, and to meet that I ordered steam to be left in night and day; that is to say, the steam for heating purposes, to keep the place warm.

4091. They were not satisfied with the heating steam, they wanted the live steam?—They wanted the live steam; and the week-end following I cut the pipe where we thought it was choked. We did not find anything there, and we went to the tap, and we found it choked, and put a wheel valve on in place of the plug tap. There has not been any complaint since.

4092. After you had replaced this tap with a new one the weavers were perfectly satisfied?—I had no complaints whatever after that.

4093. With regard to the Prospect Mill, where you did not put any steam jets originally, I suppose you would not have put them in had it not been for the representations of your employees; they first of all brought it to your mind that it was necessary?—Yes.

4094. And they practically insisted, as far as their insistence could go, on your putting in the steam jets?

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Mr. J. HOLDEN.

—That is it, but you know in a new building there is always more or less of humidity. A new shed is not so dry as an old shed, and that was another reason why I did not put steam in, and I thought I would try it and test the thing fairly whether we could do as well without steam as with it.

4095. From your practical experience I take it that even with such a low percentage of size as 5 per cent. it is impossible to weave successfully without artificial humidity?—I think it is. I think for weaving purposes a little steam is highly beneficial.

4096. (*Chairman.*) There is a wide difference between "impossible" and "highly beneficial." I think we must realize that.

4097. (*Mr. Roberts.*) I said for successful weaving; keep to that?—For successful weaving it is better to have steam than not.

4098. (*Mr. Hartley.*) I wanted to ask this general question, Mr. Holden. You have told us that in the early part of last year the weavers were making a great outcry in the county about this excessive steaming?—Yes.

4099. Did you yourself have any complaints from your own workpeople, or had you at any time any reason to believe that they objected to steaming?—No, not at any time.

4100. So that as far as your workpeople were concerned there was nothing inconsistent in their asking to have it put on again—nothing inconsistent with what you had previously heard from them?—No.

4101. There had been nothing said to you that made you take the step you did or stopping steaming for some reason last year you say?—No, I did not stop it, but I did not put it in.

4102. That is in the case of the Prospect Mill. In the case of the other mill the steaming had been so diminished until it practically vanished?—Yes.

4103. You let them work under those conditions for some time?—Yes, but unknowingly.

4104. Was this agitation anything that belonged to your own place or was it a general agitation?—A general agitation throughout the county.

4105. You got alarmed at it, and thought you would have trouble with your workpeople?—I took this view, that the leaders of the operatives were generally denouncing the use of steam; I thought it was just possible they might prevail on the authorities in

London to do something by way of doing away with it altogether. That was my idea.

4106. But in your own experience you have seen no objection on the part of your own operatives to steaming?—No. In the Hindle Street Mill there are only nine jets. There is not sufficient in there at any time ever to get an excess of humidity. When this thing is more settled I should like to put more in. I have put eighteen in the new mill for 320 looms. I have only nine jets for 510 looms.

4107. (*Mr. Thomas.*) You have only nine jets in the Hindle Street Mill?—That is all.

4108. How many looms have you there?—510.

4109. How many jets?—Eighteen for 320 looms.

4110. So you turn out double the amount of steam?—We can stop them you know.

4111. What class of goods do you work?—Mostly bleaching goods. Some are for grey shipment.

4112. You only put 5 per cent. of size?—We just make them for weaving purposes.

4113. Just weavable?—Yes.

4114. Supposing that the authorities in London had decided to stop the steam, what would you have had to do then in order to make it weave as well as it does now?—I do not know. I do not know of anything that we could do.

4115. Could not you do it by altering your sizing?—I do not think so.

4116. The sizing has got nothing to do with it?—It has got something to do with it, certainly.

4117. Can you tell us how much?—With a small quantity like 5 per cent. you cannot do a great deal. It is not like putting 100 or 120 per cent. of size on. The ideal weaving weather, to my mind, is when there is a soft, mild, humid atmosphere, something that would make cotton goods mildew quickly.

4118. Rain every day, and then we get some weaving weather?—It wants something besides rain; it wants warmth besides, and you do not want high winds.

4119. (*Mr. Hartley.*) I omitted to ask one question, that is about the counts of yarn that you use. Tell us roughly the average counts?—From thirty-sixes to forty-fours American yarns, and then from fifties to seventies in Egyptian yarns, and all sorts of wefts. My experience is that the workpeople themselves would rather have steam than be without it. It does not suit all weathers, you know.

The witness withdrew.

Mr. EDWARD BRAMLEY, called and examined.

4120. (*Chairman.*) What are you, Mr. Bramley?—Weaving manager.

4121. At what mills?—At Griffin Mills.

4122. Situate where?—At Witton, Blackburn.

4123. The Griffin Mills. Are they humidified or non-humidified mills?—They are both humidified.

4124. I understand you have had experience in both humid and non-humid mills?—Yes.

4125. How long experience have you had in non-humid mills?—Over 20 years.

4126. What class of goods?—Medium size and light size.

4127. Medium is up to about 50 per cent. or something of that sort?—No, 25 per cent., hardly medium.

4128. What class of goods do you say you manufacture in the dry sheds?—All plain goods—best British shirtings.

4129. What are you manufacturing now in the humid sheds?—About the same class of goods.

4130. Then you will be able to draw some comparative results?—Yes.

4131. You can form some opinion as to comparative results?—Yes.

4132. We will take it first from the weaving point of view. The warp is the same at both places, is it?—It is the same at both places, but not exactly the same size.

4133. From a weaving point of view, from which do you get the best result, the humid or the non-humid?—There is no doubt about the humid at all.

4134. You get the best results from the humid shed?—Yes, undoubtedly.

4135. So far as non-humid sheds that you have had experience in, was there any ventilation of any sort?—During the latter part, perhaps seven years ago, we put in two Blackman air propellers. That was in a shed of about 630 looms.

4136. As far as you could judge, what was the condition of the atmosphere in the non-humid shed?—Well, we were very hot in summer, and I believe now that where we steam we are fresher.

4137. You say it was very hot in summer?—Very hot in summer in the non-humid sheds.

4138. In winter did you appreciate any smell or any unpleasantness in the shed?—I cannot say that I ever took that much notice. We worked on without perceiving any.

Mr. E. BRAMLEY.

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4139. It was not very noticeable?—No, not noticeable.

4140. Of course, there are some days that are good weaving days?—Yes, I should call to-day a very nice weaving day.

4141. Supposing the wind went round to the northward and eastward, what would happen in the dry shed?—I should simply say that we should get a good deal worse work from the weavers; the weavers would have a good deal more work to produce the same quantity of cloth.

4142. Would it result in the ventilators all being closed up?—I may say that on a frosty morning I have gone in, as a manager, before six o'clock, and I have knocked off the fan straps to avoid complaints from the weavers.

4143. Am I right in supposing that on what is known as a bad weaving day any ventilation would be stopped up?—Yes, as much as we could.

4144. You know, I suppose, that a certain amount of humidity is necessary for weaving?—Yes, I have always thought so both as weaver, overlooker, and manager.

4145. Now in the dry sheds do they get that humidity?—Well, there are three or four ways. Before the Act of 1889 we steamed from small jets out of a 4-inch warming pipe. When the Act came in force these jets were taken off and we degged the floor with water. But this was stopped 18 months before I left Preston.

4146. How did you get it?—We had a town's water pipe through the shed and two or three branches for different men to take out, and we degged at night when it became stopping time.

4147. As a matter of fact, you got your humidity by degging?—We got humidity by degging.

4148. Can you tell us anything about the CO₂ in those sheds?—There were certain tests taken, but we were not under the Act. There were no official tests taken that I ever remember. There were none in my time of management.

4149. Where was that mill?—W. Calvert and Sons, Aqueduct Mill. I had been brought up at Flatts' Mill, and had gone there as an overlooker.

4150. You were overlooker or manager?—I became manager there before I came away. I am manager now for Mr. Adam Dugdale, of two large humid sheds.

4151. How do you humidify there?—In our Witton shed, which has about 736 looms, we have five sections of Hart's; but I may say, to assist those, for certain hours of the day we have steam jets.

4152. And from your point of view, is the atmosphere of the shed satisfactory?—It is very satisfactory till you come on the hot weather, and that takes place generally in the afternoon. I believe I have some readings. I was there in 1905, and I kept a few readings, and averaged them.

4153. You are talking of the humid shed of which you are in charge?—Yes. These are the afternoon readings averaged, and this is the average for the month. In June, 1905, the heat was 78·40; the wet bulb was 69·76. That was the side of the shed. The centre was 78·64 and 70·92. The same shed in July, for all the month, in the afternoons, between three and four o'clock, showed at the side, 79·78 dry bulb and 70·54 wet bulb.

4154. A considerable difference between the wet and the dry bulbs?—Yes. The centre of the shed was 78·83 dry, and the wet bulb was 71·16. That is the whole average for the month.

4155. Do you do anything to try to keep down the temperature in the hot weather, beyond the lime-washing of the shed, of course?—We have the side ventilators, that is all; that means wall ventilators. All our outside walls face open spaces.

4156. You have a combined humidifier and ventilator?—Yes.

4157. At the entrance where the air comes in on the roof there is some matting moistened?—On some. We have not matting.

4158. Have you ever tried it?—We have not tried it since I came. I believe a place close to has tried it, and I do not believe that their temperature is any lower than ours. I have some notion that it helps to stop the air. I may not be right. Of course, I have taken a lot of notice of these things.

4159. No doubt it would to some extent, you would have to run your fans a bit faster?—We have not done that. We should have to put on piping for town's water to run down the matting.

4160. What water are you using now?—For steaming we use town's water.

4161. A second boiler?—We do not use any brook water for any of our boilers; it is all taken out of our steam boiler.

4162. Do you use town's water for your boilers?—Yes, every gallon of water we use in the boilers is town's water. The water is a tremendous cost to us.

4163. (Mr. Higson.) The river by you is very dirty, I know?—Yes, very dirty indeed. It is scarcely fit for condensing with.

4164. (Chairman.) I suppose you use it over and over again?—The boilers are regularly emptied and cleaned.

4165. You have condensing engines?—Our condensing water runs away when we have done condensing in another part.

4166. (Mr. Higson.) The condensing water is taken from the brook, Mr. Chairman.

4167. (Chairman.) We had got to the question of the roof and the matting, but you have not tried that?—We have not tried that.

4168. You have not tried to bring the temperature down?—No.

4169. Have you had any complaints about steaming from your workers?—I do not think I have had a complaint, except a complaint about draught occasionally; but I may say that Hart's have been very good; I have been very fortunate in trying to manage them. Well, it has not been above one or two complaints. We have always a few faddy people that imagine something.

4170. They have not, you say, raised objections to the use of steam?—None at all. We have had complaints of draught, but that has been in a case where we have been bringing in nothing but air, when the steam has been totally shut off.

4171. Then, of course, it has been cold; but you can heat the air when it comes in if you like?—We warm the place in winter weather; we bring in the top steam and the bottom steam.

4172. Through the coils?—Yes.

4173. (Mr. Hartley.) As far as you are concerned, you never heard any complaint from your own workpeople about steaming?—None at all.

4174. There is no objection to it as far as you know?—None that ever I have heard since I began to use steam. I repeat again that in both sheds I have been asked to put in steam when we knew we were getting too hot.

4175. (Mr. Roberts.) When it has been hot they have asked you to put it in again?—Yes.

4176. Your experience as a practical man, having had experience in both humid and non-humid sheds, is that humidity is the best?—I feel certain that we can get the best results.

4177. And you feel certain that the workpeople like humidity best?—I can nearly vouch for that. If we did anything contrary to that, we should have to alter it in a month.

4178. (Mr. Thomas.) You think they are as comfortable in a humid shed as in a dry shed?—I feel so, and I am pretty often about.

4179. Are you always in the shed?—Well, I spend a fair amount of time in, and don't feel any bodily discomfort, although I always have my coat on.

4180. You set to with the tackling men when required?—Yes, there are plenty of jobs I do which

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Mr. E. BRAMLEY.

require a bit of exertion, and I do not feel oppressed with the heat. I should say it would not be possible to go on comfortably without steam, and we have a good class of yarn.

4181. You have about 25 per cent. size?—Yes.

4182. After that statement that you do not think you could go on comfortably without steam, I ask you, how is it that hundreds of sheds go on comfortably

without steam and with that percentage of size?—I do not know about hundreds.

4183. Say a score?—Where I came from we went on moderately well. They do not deg now. They did not deg for eighteen months before I came away. We did well, but we had a special sort of work, and I think everybody in this country cannot afford to make that class of work. We had special yarns.

The witness withdrew.

NINTH DAY,

Thursday, April 9th, 1908.

At Glasgow.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. WILKINSON HARTLEY.
Mr. HENRY HIGSON.
Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
Professor JAMES LORRAIN SMITH.
Mr. F. THOMAS.

Mr. D. R. WILSON (*Secretary*).

MISS MARY MUIRHEAD PATERSON, called and examined.

4184. (*Chairman*.) Miss Paterson, you are one of H.M. Inspectors of Factories?—Yes.

4185. I think you have been an inspector of factories for 14 years?—For 15 years.

4186. You have had considerable experience not only in Scotland but all over the kingdom?—Yes.

4187. You have had, I think, opportunities of visiting not only humid but non-humid weaving sheds?—Yes.

4188. We know, of course, that you are well acquainted with the law relating to non-humid weaving sheds?—Yes.

4189. You know that there are what are called cotton cloth factories?—Yes.

4190. And that means that they are artificially humidified?—Yes.

4191. And there are other weaving factories which are not classified?—Yes.

4192. Which means that weaving is carried on without the aid of artificial humidity?—Yes.

4193. In the humid factories there is, I think, a standard of ventilation?—Yes.

4194. Is that measured by 9 parts of CO₂ in 10,000 parts?—Yes.

4195. In the non-humid sheds, I understand, there is no standard of ventilation?—No standard.

4196. In your many visits to the weaving sheds, have you been able to draw any comparisons between the apparent comfort to the workers in the two classes of sheds?—Yes, I have no doubt in my own mind that a well-ventilated non-humid shed is a more comfortable place than a well-ventilated humid shed.

4197. That a well-ventilated non-humid shed is more comfortable than a humid shed?—Yes, of course, where the maximum limit of humidity is attained, or something near the maximum.

4198. On what do you base your opinion, Miss Paterson?—Very largely on interviews with workers, with the women and girls there, and on the communications received from them, and statements made by them.

4199. Then I gather that the conclusion you arrived at after consulting the weavers is that they work with

greater comfort where there is no artificial humidity?—Yes, given good ventilation.

4200. We may take it that in the humid sheds there always is good ventilation?—I think now there is. Some ten years ago or so I was in those a good deal, and ventilation then was not nearly so satisfactory as I think it is now.

4201. I suppose, generally speaking, the standard is maintained now?—Yes.

4202. The 9 standard?—Yes, I should think so, though I have not made any tests at all myself.

4203. Coming back to the non-humid sheds, you lay particular emphasis, and rightly, on a well-ventilated non-humid shed; but have you found, as a rule, that the non-humid sheds are well ventilated?—No.

4204. They are not well ventilated. Have you considered the effect from the humidity point of view where there is not good ventilation? I should, perhaps, explain myself. We will assume, for the sake of putting the question, that this is a so-called dry shed, that it is a bad weaving day, the wind from the east or from the north, and that the fans are stopped, and probably all ventilation stopped up. Of course, there will be a considerable amount of humidity given off from respiration and from perspiration from the bodies of the workers, and the room, although in one sense a non-humid one, would become a humid one?—Yes.

4205. Have you considered what effect that would have upon the workers?—I think that that is the effect on the workers that one would get in a humid shed if the ventilation were not maintained. The workers have a certain amount of discomfort and languor in these sheds.

4206. Of course, one quite realises that any opinion must be more or less speculative?—Yes.

4207. Because it would require a long investigation to give definite opinions?—Yes, but I have been rather struck by the appearance of languor.

4208. Still, you would realise that in a place of that sort the impurities must be much greater than in a shed where there is mechanical ventilation?—Yes.

4209. And it is a question, perhaps, for the doctors to say what effect that would have upon health?—Yes.

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4210. But as far as your own personal feelings are concerned in going through the different non-humid sheds when the ventilation is stopped, have you found any oppressive feeling in those sheds?—I think they are less comfortable than a humid shed with the ventilation.

4211. Have you, in making inquiries in Lancashire and elsewhere, heard any doubts expressed by the workers in regard to the accuracy of the returns of humidity that are made?—Yes, I have heard a good many doubts expressed, and I have had from time to time a good many complaints that the returns were not correct.

4212. Have you examined the records in the different sheds?—Yes.

4213. What opinion did you form—I mean to say, from what you heard yourself and what you saw on the record in front of you, did you form an opinion that they were fairly well kept or otherwise?—Fairly well kept, but not invariably correct, I think. I found a good many just in this last visit to Lancashire; I found several cases in which I visited during the hour specified as the time at which the record was to be entered up, and found it not entered up at all during that hour; the entry was made, for instance, between four and five instead of between three and four.

4214. We are not assuming that the records are not properly kept as far as they can be, but could you make any suggestion that would give confidence to the workers and make them feel that they are accurate?—I have thought that it would be a good plan if the workers elected someone, or selected someone from their own number, to be partially responsible to go round with the manager or foreman or whoever makes these entries on behalf of the firm; that such a person should go round at the same time and sign the entries something like a check marker, and an entry should be made of the exact time at which the record is taken, and should be signed on behalf of the workers as well as by the firm's representative. I think more confidence would be given to the workers by that, and I think it would also lead to a little more effort to understand the meaning of the hygrometers and the meaning of the humidity on the part of the workers.

(*Chairman.*) I propose to ask any other members of the Committee to ask any questions, and perhaps you would be kind enough to make any statement after they have asked their questions, because there may be some statements that you would like to make that we have not asked you.

4215. (*Mr. Higson.*) You suggested that a non-humid well-ventilated shed was much more comfortable than a humid shed similarly ventilated?—Yes.

4216. Had you any experience of the conditions of weaving in a well-ventilated non-humid shed?—Yes, I have been in mechanically ventilated sheds, but I have no knowledge of it from tests. I have not made any tests of the air.

4217. I was only speaking from the point of view of the quality of the work that would be produced. You know that material sometimes weaves bad in Lancashire mills and sometimes well, and the condition of the atmosphere determines very often whether it does weave well?—I know that. In some sheds where mechanical means of ventilation have been put in, the difficulty of weaving at times accounts for their not being used.

4218. Then you do know that a well-ventilated non-humid shed under certain conditions weaves worse than a humid shed?—Yes, it depends; it is largely a matter of the sizing.

4219. (*Mr. Shackleton.*) I would like to be quite clear on the point just asked by Mr. Higson as to what is the difference in your mind which makes a well-ventilated non-humid shed better than a well-ventilated humid shed. What is the difference?—It is a little difficult to explain just one's feelings about it. I think the humid atmosphere is always more trying myself than a dry.

4220. The only difference of course between the two, so far as bodily discomfort or comfort is concerned, would be the humidity?—Yes.

4221. Do you ascribe it to that?—Yes, and I have found from the workers, judging from the communications and statements made to me, that the heat of a humid shed is more trying than the heat of a non-humid shed; that is to say, they feel more oppressed by the heat at say 68° to 70° in a humid shed than in a non-humid shed; and I think that is really my own feeling about it: that in a humid atmosphere one cannot stand the same heat.

4222. You have asked questions of the operatives with regard to these matters?—Yes.

4223. Have any operatives ever said anything to you as to what their medical advisers have said to them during times of illnesses of various descriptions?—Yes, a good deal of that. In Lancashire, in the neighbourhood of Blackburn, there is as it seems to me a good deal of rheumatism. Many of the workers have told me that the doctors have told them that they ought to leave the humid sheds. I have not followed up any of those cases by seeing the doctors, therefore, I cannot go further than hearsay.

4224. They have told you that the doctors said that?—Yes, I have heard that from a number of workers who have left the weaving and gone to other work on account of that.

4225. What district was that in?—Round about Darwen mostly lately; but I have heard it in Blackburn, and many years ago, round about the Haslingden district.

4226. (*Mr. Thomas.*) Do you receive as many complaints with regard to the ventilation of non-humid sheds as you do with regard to humid sheds? Perhaps I might put it in another way. Do you receive any complaints at all from the operatives with regard to ventilation of non-humid sheds, the air being oppressive and overpowering particularly in the hot summer weather?—Being too hot?

4227. Yes?—Yes, I do. I receive from both, I think, a certain number of complaints.

4228. Do you receive any complaints in winter time from the non-humid sheds with regard to ventilation?—I would not like to say I have not; but I do not remember any at this moment. Workers complain much more of being over-heated or being too cold than they do of want of fresh air.

4229. (*Chairman.*) I will just read this last paragraph of your memorandum. "I am of opinion that a well-ventilated dry shed is a pleasanter and healthier place to work in than a humid one; but the ventilation of a dry shed is seldom maintained efficiently even when means are provided. Mechanical means are the only satisfactory ones, and where much dust is created in the weaving, some method of removing it directly might be required." Then you would suggest that there should be mechanical ventilation in all non-humid sheds, would you?—Yes, it is the only thing I have found satisfactory.

4230. And as to the removal of dust, of course, I think we are all absolutely agreed that if it could be done it would be very desirable, but it is a very difficult practical question. Have you thought that out at all?—The only looms in which I have ever found any means of that kind that were effective at all were in an asbestos weaving shed where there was a means of removing it from the front of the loom where it was being done.

4231. Where is that?—In Rochdale. I saw a very similar appliance on some winding frames the other day; just where there was a trunk or duct leading to a fan for exhaust.

4232. (*Mr. Higson.*) It is exhausted; drawn downwards?—Yes.

4233. That is quite common?—It was new to me until a very short time ago.

4234. (*Chairman.*) Anything to be efficient would have to be local?—Yes.

4235. You would have to have it close to the source where the dust is generated, and having so many of these local exhausts running in a shed would affect these local exhausts running in a shed would affect a great extent, so the question is a difficult one?—Yes.

4236. (*Mr. Higson.*) You could not have an arrangement to exhaust the dust from a loom very well. It

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is largely used in coloured winding where poisonous colours and fibre are given off. The threads run over a table to which an exhaust fan is attached; and the dust is drawn through a tube?—It is done also on asbestos looms.

4237. (*Chairman.*) Is there any other point you would like to bring before the Committee?—I think I should like to speak about the meal hours in the humid sheds where I have found so often the steam turned on to some extent, while of course the means of ventilation are stopped and where they have live steam. I have visited a good many sheds in the meal hours lately, and I find that there is always steam coming in during meal times; and even where that does not happen, and where the ventilation is stopped and there is still the influence of the humidity in the shed, I think it is not a suitable place for the people to have their meals in. I have felt that very strongly on these recent visits. The air is very close and very oppressive, and the workers ought to have some other place provided for them.

4238. That would mean that meals should not be taken in the humid sheds?—Yes, that prohibition should be made for all; not only for those that have been more recently built.

4239. There is a point that struck me. Have you considered at all the question for provision for the clothing of the workers?—Yes, I think also that cloak rooms should be provided in these factories and in all factories. I do not find that the workers hang up their things now so much as they did. They fold their shawls up and put them on the loom, and from examination I do not find that they get really wet or moist. Whether or not they get dry on a wet day if they come into the sheds wet I do not know.

4240. (*Professor Lorrain Smith.*) You attach most importance, I gather, to the temperature. Most of what you have said depends on the discomfort of a high temperature?—I think it is the moisture that causes the discomfort.

4241. The moisture makes the high temperature more disagreeable?—Yes.

4242. It is the temperature that you apparently attach the most importance to. You did not draw any very clear distinction between a dry shed with a high temperature and a humid shed with a high temperature?—I do not find that the weavers object to such a high temperature in a dry shed as they do in a humid shed; I suppose that is because the humidity makes the temperature more trying. There is one point in connection with humid sheds I would mention. I receive a good many complaints, or have received a good many complaints, during the last few years about the condition of the floors, and I find that the floors are very commonly wet in those sheds, and that the workers object to that very much. It seems to be a matter of the moisture in some way coming through the floors or flags, and there seems to be no method of keeping many of those floors dry as long as they are laid in the way in which they are laid now.

4243. (*Mr. Roberts.*) I did not catch that.

(*Witness.*) I was speaking about the flagged floors in the sheds. It seems to be impossible to keep those dry laid as they are now; and I think it would add very much to the comfort of the workers if there was a regulation that the floors should be kept dry, because very often where you have live steam there is a good deal of leakage from the steam jets; but apart from that the floors seem to be moist.

4244. You have seen that?—Yes, I have seen that a great deal.

4245. Apart from any leakage?—Apart from any leakage.

(*Mr. Roberts.*) I think we have not been able to find anything of that sort; we have not found any wet floors unless we could find a cause for it such as leakage.

(*Chairman.*) I think we have found a good many sheds where we have been told that the subsoil is very moist, and consequently the introduction of artificial humidity has not been so much wanted. I think it has been very freely admitted to us in many places that a shed is built in a place where the subsoil is moist, and intentionally so.

4246. (*Mr. Roberts.*) That is so, but we have not found these wet floors.

(*Witness.*) I have found them in a great many sheds just lately. I do not mean water lying in pools; I only mean that the floor has been wet instead of being dry.

4247. (*Mr. Roberts.*) Black?—Yes.

4248. (*Mr. Shackleton.*) Have you found that round in the Darwen district?—Yes, I have found that a good deal in Darwen in almost all the sheds I visited there.

4249. (*Mr. Hartley.*) I was wondering whether you had noticed the same thing in dry sheds—a black floor?—No, I have only noticed it in dry sheds where they have been sprinkled on purpose for the weaving.

4250. Have you been much in Burnley, Nelson and Colne district?—No, very, very little.

4251. You have not visited the district where the dry sheds are; they are located mostly at that end of Lancashire?—I have visited a good many round about Manchester, and, of course, the dry sheds in Glasgow, I know all of them.

4252. (*Mr. Roberts.*) But they have wooden floors?—They are wooden floors.

4253. (*Mr. Hartley.*) I suppose you mean by the observation you made just now that the damp you see on the floors has come through the artificial humidity, the steaming?—It very often seems to have come owing to the subsoil from what I understand from the managers.

4254. (*Mr. Higson.*) There are some sheds that give a certain percentage of moisture in the atmosphere, and they have a black floor?—Yes.

4255. In others the manufacturers would be very glad to get them black and cannot manage it?—Yes, possibly.

4256. You suggest that it is very objectionable for the workers to take their meals in the shed. Do you mean to exclude them from both humid and dry sheds?—I was only thinking of it in connection with humid sheds, because of the steam not being really stopped.

4257. Have you been in sheds where you found steam still blowing during the meal hours?—Yes, that obtains mostly where the control of the steam is in the weavers' hands.

4258. (*Mr. Roberts.*) Seeing that they do not use the cloak-rooms at present, you do not seem to lay particular stress, or you do not see any objection, to their putting their clothes down by the looms in the shed?—I think it is a much better plan in factories that cloak-rooms should be absolutely required for other reasons.

4259. Where they have them they do not use them in many instances?—I think it should be made compulsory to use them. I think they should be provided. I am afraid I did not lay stress on it because I have said it so often.

4260. Who is going to compel the operatives to use them?—Whoever supervises them.

(*Mr. Roberts.*) The law cannot, evidently.

4261. (*Chairman.*) As that question has been raised again, of course we know that in all humid cotton cloth factories erected after a certain date it is compulsory to provide cloak-rooms?—Yes.

4262. And there is a very large number of places where there is no cloak-room, and it has been stated to us that any suggestion to provide a cloak-room would be impracticable inasmuch as there is no room; people cannot find the space?—Yes.

4263. Assuming that that is a valid objection, can you suggest any alternative provision for the clothing?—I have seen something in Belfast, I think.

4264. That is what I had in my mind; wardrobe arrangements are actually in the spinning rooms there.

4265. I think there is a regulation that in rooms where the two thermometers, the wet and the dry, get within a certain distance, there shall be a sort of little lockers on the side or some provision of that sort?—Yes, but any provision that is not for hanging up the clothing I think is bad.

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4266. Have you noticed in cotton cloth factories that clothes are hung on walls and on pillars where there is a considerable amount of condensation?—Yes.

4267. Would those clothes get wet?—Yes, clothes really do get wet I think.

4268. And would something in the shape of lockers with a board such as we see there (*referring to a boarding round the room about 3 ft. high*) and pegs

to hang clothes on to some extent obviate that?—It would, if there was no condensation there. It would need to be very well done, I think.

4269. The condensation on wood and on metal and on damp walls would be very different; there would not be the same condensation; or, it would be quite possible to put a warm air passage behind?—Yes.

4270. And, of course, partitions to separate the clothing?—Yes.

The witness withdrew.

Dr. WILLIAM PATRICK, called and examined.

4271. (*Chairman.*) Will you please state your qualifications?—I am L.F.P.S.G., M.D. of the Glasgow University.

4272. And I think you are one of the Certifying Surgeons?—Yes.

4273. You have been acquainted with the process of weaving from early boyhood?—Yes.

4274. Have you any knowledge of the processes other than from the professional point of view?—No.

4275. You have been associated with weaving sheds for how long?—I was appointed twenty-five years ago, and I have been seeing them from time to time all that time. Previous to that I was only there as a visitor occasionally.

4276. Your duties as Certifying Surgeon are to examine the young people and children, and to inquire into accidents?—Yes.

4277. Have you had any opportunities of going into the sheds and forming your own opinion with regard to the sanitary conditions in them?—During the investigation of accidents I get into the sheds at once, and if I signify any desire to go into the sheds the managers are always very willing to take me in, and show me anything I want to see.

4278. That is what I want to bring out, because I know that the duties of a Certifying Surgeon take him into a shed only for the purpose of investigating accidents, but I also know that where a Certifying Surgeon shows an interest from a sanitary point of view, facilities are generally offered to him?—Yes.

4279. Have you availed yourself of those facilities to go into the sheds and study their conditions?—Yes, from time to time.

4280. You are probably aware that there are technically two classes of sheds, one class known as humid cotton cloth factories, that is where artificial humidity is introduced?—I have been made aware of that, although I have never seen any with artificial humidity.

4281. The class of sheds of which you have a knowledge are what are generally known as non-humid sheds?—Yes.

4282. You probably have some knowledge of the Factory Acts?—Yes.

4283. Is it within your knowledge that in artificially humidified sheds there is a standard of ventilation?—Seeing that I have not been in any sheds where there was artificial humidity I have paid no attention to that.

4284. You have not considered that question?—No.

4285. I will just mention for your information, in case it is information, that there is in those sheds a standard of ventilation that there shall not be more than nine parts of CO₂ in 10,000?—Yes.

4286. Have you ever considered whether it is desirable to have a standard of ventilation in the non-humid sheds?—No, I could not say I have considered it is necessary to have a standard; more than that when I have gone in I have looked round about me, and my senses have contributed to inform me of the sweetness or stuffiness, or otherwise smelliness, of the place.

4287. What general conclusions did you come to from your sense of smell?—The feeling that I had was that the places were uniformly comfortable. The

air space is very considerable overhead; there is a fair interchange of air between the outside and the inside through the ventilators, and sometimes through the windows, and by the doors.

4288. I am now talking of non-humid sheds. In your own experience how are those places ventilated?—They have windows that open. The lighting is from above, and some of those windows are easily opened; they have ventilators in them. Those are occasionally opened. They are not always opened, but are occasionally opened. Some of the workers complain of a draught blowing down upon them, and they object to that, and take the first opportunity of closing the windows.

4289. What has been your experience, we will say in winter; have you generally found the ventilators closed or the ventilators open?—In winter they will be closed. At meal times the doors would all be opened.

4290. Have you given any attention to the relative amount of humidity that is found in these sheds?—Of course the processes are all dry processes. The only humidity that I have ever seen was in the dressing sheds.

4291. I mean the relative humidity of the atmosphere in the weaving sheds?—No, there would be no difference; the air would be a little drier in the sheds than outside. I have been told, for instance, of a spinning master upon whom a man called advertising an artificial humidifier who wished an order from him; but when tested there was more humidity in the place than he could actually have given.

4292. There was more humidity inside?—Yes, it was not produced by any artificial means, but was the natural atmosphere.

4293. You have stated, I think, that generally speaking in winter the ventilation is closed?—Yes.

4294. You know that there are a large number of workers?—Yes.

4295. And am I right in supposing that from respiration and perspiration a considerable amount of humidity would be given off?—Yes, but the air space is so great that that would not be injurious to anybody; it would not be perceptible; that is to say, the windows either above or on the sides, if they happened to be on the sides, would not have any humidity condensed upon them.

4296. I am now thinking of the purity of the atmosphere. We also have considered the humidity, but in your opinion the humidity given off from the body and from breathing would not produce sufficient humidity to make it oppressive?—No.

4297. Would not it contaminate the air very considerably?—Not considerably, very slightly it must be. In a place, for instance, where there may be 500 workers the space must be very large, and there will be doors opening from time to time, and the interchange of air from the outside to the inside renders it more natural.

4298. What is the generally accepted test for purity of air—I mean what is generally accepted as a good test?—A good test is just the sensation that is conveyed to the persons working in it, and their general health.

4299. Have you any knowledge of the carbonic acid test?—No, I have not.

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4300. You have never tried the carbonic acid test?—No.

4301. Are you aware that, generally speaking, the amount of carbonic acid in the atmosphere is taken as not an accurate standard but as a measure of the purity of the air?—Yes, I am aware of that.

4302. Have you any knowledge of the amount of carbonic acid that would be found in one of these sheds when all the ventilation is stopped?—And all the work going on?

4303. Yes.—No, I have never heard of any mill in which it was tried.

4304. You personally have taken no tests at all?—No. I have not; and I have said so in my notes.

4305. However, not having taken any tests, do I gather that in your opinion with the number of people that there are in these sheds, breathing to some extent the air over and over again?—Excuse me, I do not think that is so.

4306. I am assuming that the ventilation is stopped?—The ventilation is stopped and the doors closed; but that is never the case. The workers work from six o'clock to nine, and then there is an interval of an hour, and during that hour the place is quite open. I do not know any mill that is not opened up, allowing a free current of air right through it. Then again, at the dinner meal hour, two to three, it is so. One or two factories that I know of have only one break in the day.

4307. The longest period of employment would be how many hours?—Four hours or four hours and a half. One firm has four and a half hours and four and a half hours, that is nine hours a day with a break between.

4308. (Mr. Shackleton.) I should like to ask you what is your general impression of the health of the operatives in your Glasgow mills as compared with any other occupation?—My impression is that generally it is very good. I have hinted here that indigestion comes in, but I do not think that is so much caused by the work that they are engaged at as by certain errors in diet.

4309. Which are peculiar to cotton operatives, do you think?—Oh, dear, no.

4310. You would not give that as a cotton operative's disease?—Not at all.

4311. Is there any complaint made to you or to any of your medical brethren by cotton operatives in this district as to anything arising out of their occupation?—No.

4312. (Professor Lorrain Smith.) No rheumatism?—No, I can only remember one case of a man who was a beamer; he was beaming for a length of time, some weeks on end, yarn dyed with chromate of lead; he had lead poisoning, but he recovered from that readily.

4313. (Mr. Shackleton.) We should not put that down to any cotton weaving; that was in the preparation department, a special mixing?—Yes.

4314. (Chairman.) There are regulations to meet that.

4315. (Mr. Shackleton.) Have you ever thought about the extra number of people there are in a weaving shed compared with Lancashire conditions? You probably have in a Glasgow shed as many operatives again as you would have in a Lancashire shed?—So I am told. I do not know anything about the Lancashire mills, but I have been told that is so. There are a number of young persons, that is to say, girls, under eighteen years of age, who are working one loom; there will be a row of them, one girl to one loom, and so on. The rule is that if the worker is matured and skilled enough she has two looms, and in some of the plain cloth mills they will have three looms; and there is one mill at any rate in which they work the Northrop looms, where they have a number of little girls assisting to put in the cops, and one woman attends to ten looms perhaps with the girls assisting. The looms stop automatically.

4316. The reason I ask you is that you will have more humidity and more bad air given off in a given area in your sheds than we have in ours. You said in your evidence that you have not taken any tests?—No. I have not.

4317. You could not say anything as to the effect of that?—The high probability of there being more humidity in one of the factories here—

4318. More CO₂?—More than there is in your factories in Lancashire—well, that is very likely, but you must recollect the great space that a shed occupies. I asked, for instance, —'s people, and they tell me that they have 641 looms in one mill, and they have some 500 workers; that means in the preparation department as well. I want you to recollect that the space from the floor to the lights at the apex is no less than 21 to 22 feet. It is a great space above their heads.

4319. Take it generally, you would say there is no ill-effect from the conditions they are working under?—I would say so.

4320. (Professor Lorrain Smith.) What about the discomfort in the hot weather?—There is not very much complaint of that. I have not heard much of that. They complain more in the cold weather. For instance, at — and in one or two other mills they have lately lighted their works with electricity, and though it made the air better it was colder; there was a little more carbonic acid floating in the air before then with the coal gas not being completely burnt. Now they have no coal gas burning; they have electricity instead. Some have adopted incandescent burners for their gas, and they burn the gas more completely, and the air is purer there.

4321. (Mr. Hartley.) You have not heard complaints from the operatives of oppression in the hot weather?—No.

4322. You have not noticed any languor or jadedness about the operatives in very hot weather?—No, really we have not very much hot weather hereabouts.

4323. (Professor Lorrain Smith.) 1906 was a hot year, was not it?—Yes, and 1905 was a very good summer, but there was really very little complaint of that. I notice that if the weather is at all good they go out a good deal into the open air at meal times.

4324. (Mr. Thomas.) This is running in the minds of a number of people at present; the operatives in this district have two meal hours; they have two full hours, from nine to ten and from two to three. Perhaps you could tell us whether a large number of people stay in to their meals, say, at the first meal hour, from nine to ten, or even in the second meal hour?—Not a very large number. It would be difficult to tell that; perhaps a fourth part might remain about the mill. They might go out into the yards. There are private restaurants in the adjoining streets near the factories, and they go out to those places, although all the factories provide hot plates or steam chests or copper boilers to enable them to cook food for themselves. Those parties who cook their own food are parties who come from a distance, say, from Rutherglen, say, from a distance of a mile and a half or two or three miles. Those are the individuals who stay in about the works.

4325. About 25 per cent. you say, roughly?—Perhaps about that number. Miss Paterson drew my attention to a girl of fifteen that I had passed. She thought she was anæmic. She was certainly not very well developed, and on cross-examining her about her food I found that that girl took strong tea four times a day—at early morning immediately after getting up, then again at breakfast time, then at tea, and then again when she got home, with a minimum of vegetable matter—almost no vegetable matter at all.

4326. (Chairman.) Is there any point you would like to bring before the Committee? We have asked a good number of questions, but there may be many things we have omitted?—No, I do not know of anything. A gentleman who was manager of a mill at one time told me that it paid him to have such accommodation for the workers, that they were able to get themselves cleaned and dressed before they went out, and to sit down during the meal time; and I have often thought that factory owners would benefit their workers if they had some place of that kind adjoining each mill as part of it where they could sit down. Take, for instance, that large works—five carpet mills in my district, three belonging to one firm, the Templetons. The Templetons take very great care of their workers,

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and provide rooms a little bit outside the mills for the workers to get food in, and those workers appreciate that very much indeed. Those are workers who cannot go home in the one hour; and I have often thought that would be a great advantage in mills. There is one large place, a chocolate works, where they have a hall where workers hang up their clothes, and that is pretty well ventilated, and the clothes are better for being ventilated too. The workers in that case have overalls provided for them at the charge of the firm. The weavers do not acquire them. I have often thought it would be an advantage if they had a place to go into.

4327. (*Mr. Hartley.*) At Templetons, the place you speak of, do they provide food for the workers and charge them for it?—They do not provide the food; they provide a man, or one or two men, to run the thing. The food is supplied for them at a very low rate. They will get a good meal for 3d. or 4d.

4328. (*Mr. Shackleton.*) I want your opinion as a medical man on this matter. I will give you an illustration. Supposing in these sheds in Glasgow the thermometer registers 70° dry and about 63° wet bulb, the humidity being got by the outside atmosphere, and the workers in the mill giving off a little; and take a shed with the thermometer at 70° dry and 68° wet, or a percentage of 65 against 88 of humidity, which of those two sheds, from the point of view of bodily comfort and health, would you prefer?—I should prefer the drier one. There is enough of humidity there to satisfy all requirements.

4329. 65 per cent.?—Yes.

4330. You do not think it is a good necessary condition of affairs from the point of view of health to get up to 88 per cent.?—No.

4331. You generally would support a condition of affairs in a weaving shed where the humidity was considerably less than 88 per cent.?—Yes.

4332. (*Mr. Roberts.*) Are you aware that in many of these sheds in Glasgow, without artificial humidity

you would find a greater humidity than Mr. Shackleton has pointed out, that is, over 70?—Indeed, no; I am not aware of that.

4333. Therefore in your reply to Mr. Shackleton there is involved that they would have to ventilate those sheds and bring down the relative humidity to make them healthy?—The ventilation might be a little easier. I said to you that they objected to a draught coming down upon them. If the ventilation was just a little softer, coming in easier upon them, it would be better.

4334. (*Chairman.*) Perhaps it might be easier to the doctor if you gave the exact figures from your experience yesterday. (*To the witness.*) You see, if you know the amount of relative humidity that we have found in these sheds it will be easier for you to answer the questions, I think.

(*Witness.*) There are two of the factories in my district here where they are flatted—that is, they are not sheds, but flats.

4335. (*Mr. Hartley.*) That is, storeys?—Yes, the old-fashioned style of long ago. When I was a boy they were all flats.

4336. (*Mr. Roberts.*) I should like to ask you, Dr. Patrick, if a relative humidity of 65 is required; would it be harmful if it went up to 75?—To the workers, you mean?

4337. Yes, to the workers?—That is 10 per cent. more. I do not know that it would make much difference to them.

4338. (*Mr. Shackleton.*) If it got to 88 per cent., what do you say then?—A damp atmosphere of that kind, of course, is certainly not a very healthy one.

4339. I take it that 65 per cent. is about an average of the sheds we have examined, and you say you have no complaints from anyone of an atmosphere of that sort?—I have no complaints.

4340. But as a medical man you think if it got up to 88 per cent. you would consider it undesirable?—I think so.

The witness withdrew.

Mr. HARRY BAIRD, called and examined.

4341. (*Chairman.*) You are a member of the firm of —?—I am a director of John Brown and Son.

4342. Messrs. John Brown and Son, I understand, are the owners of two large weaving factories?—Yes.

4343. Cotton cloth factories?—Yes.

4344. Before asking you questions, I propose to explain to you exactly the objects for which our Committee has been appointed. It is, in the first instance, to consider the ventilation in what are known as humid sheds—that is, sheds in which artificial humidity is introduced—and also in non-humid sheds; and in the humid sheds to consider how far the operatives suffer bodily discomfort, or how far their health suffers, or if it suffers at all in consequence of the artificial humidity that is not admitted and sanctioned by law. I should explain to you that in what are known as the humid cotton cloth factories there is a standard of ventilation; that means that there may not be more than 9 parts of CO₂ in 10,000. That standard has to be maintained; but in the non-humid sheds—that is, sheds in which no artificial humidity is introduced—there is no standard of ventilation. Now, so far as this district is concerned, we find that most of the work is carried on under the non-humid system. I think that is the case, is it not?—It is so.

4345. In your own particular works, have you ever used any artificial humidity?—No, we have never used it.

4346. Would you tell us in general terms the class of goods that you manufacture?—Our class of goods ranges from the very finest muslins to what we call coarse, 40 counts, but mostly muslins.

4347. I take it for that class of goods you must have high-class weft and high-class warp?—The very best that is obtainable.

4348. Consequently the breakages would be comparatively few? I mean by comparatively, that if you used inferior yarns the breakages would be greater?—Yes, in fact it would be impossible to work.

4349. Have you found the humidity such as exists in your sheds to be sufficient for weaving, from a manufacturer's point of view?—Yes, quite sufficient.

4350. I am now talking from a weaving point of view; when there are northerly or easterly winds or when there is a continuance of dry winds, do you suffer any inconvenience?—Yes.

4351. To what extent would that be? By inconvenience I mean inconvenience in manufacturing?—If we have very drying winds it affects the yarns adversely.

4352. But it has never suggested itself to you to remedy that by artificial humidity?—No.

4353. Would you tell us, please, how your sheds are ventilated?—In the case of Barrowfield factory, which is the elder factory, we have a large number of Boyle's ventilators in the roof.

4354. Could you tell us the number of Boyle's ventilators?—We have ninety three-inch ventilators.

4355. Can you give us the cubic capacity of the room?—I am afraid I cannot give you the cubic capacity of Barrowfield.*

4356. Perhaps you might make a note, so we will leave a space for that. Can you give us the circumference of the Boyle's pipes?—They are 90 three-inch cylindrical Boyle's ventilators, and then we have 18 opening windows, 18 by 12.

* 1,271,725 cubic feet.

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4357. That is in that shed?—Yes, and we have seven 24-inch Sirocco exhausting fans.

4358. And in your other sheds?—We have 230 cylindrical ventilators with valves for shutting, 13 inches diameter.

4359. The cubic capacity of that room is what?—649,790 cubic feet.

4360. In the winter will you tell us, please, whether it is the custom to keep those ventilators open or whether as a matter of fact they are closed. I am not talking of the fans now?—In the Barrowfield case the Boyle's ventilators are always open; there is no means of shutting them. In the case of Clutha they are at the discretion of the various foremen; but in the morning, while we are raising the heat to a sufficient working degree, we shut the ventilators, or as many of them as will be needed to raise the temperature to what we consider proper.

4361. And the heat, I take it, is raised by radiating steam pipes?—Yes.

4362. When do you begin to heat in the morning?—It all depends on the outside conditions.

4363. In winter do you begin to heat before the arrival of the workers?—Considerably before; four or five hours.

4364. In one of those sheds you have, you said, mechanical fans?—Yes.

4365. Can you tell us approximately on how many days in the year they are run or how many weeks or months?—We only use them about three months at the outside; it depends on the summer, of course.

4366. You mentioned that the Boyle's ventilators are always open?—Yes.

4367. Have you satisfied yourself that the workers do not get up to them and close them up?—Yes, they are out of reach.

4368. And you are satisfied as a matter of fact that they are really as you suppose them to be—open? They are all open.

4369. Have you formed any opinion—I am talking now, perhaps, more of the winter when to some extent the ventilation will be less than in summer—as to the purity of the air in your sheds?—We have never felt any discomfort, nor have we had any complaints from anyone as to discomfort. There has been no feeling of closeness or stuffiness in our factories.

4370. You have experienced no feeling of stuffiness or sickness, or smell?—Absolutely no smell.

4371. Has the air in those places been analysed, so far as you know?—Never.

4372. Then you are not able to say at all what proportion of CO₂ we might expect to find?—I have no idea.

4373. Have you ever considered what moisture there is in those sheds?—No, I have never considered it.

4374. I do not mean artificial moisture, but, of course, you must have a certain amount of moisture. I will put it to you in this way. Assume this to be a dry shed, and we will assume, for the sake of taking a case, that there is an east wind, and dry wind, and that probably the windows and the ventilators are as far as possible closed to prevent the drying of the atmosphere inside. You have a large number of workers, and they will be breathing, and there will probably be a certain amount of perspiration. There will be organic impurities in the room from breathing and from perspiration. Have you under those conditions ever found the air to be impure?—Never. Of course, the only standard we have to go by is the senses.

4375. I think you said you have no idea as to the amount of moisture that there is in these places?—Absolutely not.

4376. Because under the conditions I have just described, breathing and perspiration would add considerably to the moisture, but it would also add to the impurity of the air. I will just tell you what we found in your factories.

4377. (*Secretary.*) In the Adelphi Street factory 62 per cent. of relative humidity, and in the Clutha factory 60 per cent.

(*Witness.*) May I ask what were the outside conditions?

(*Secretary.*) Practically saturated, 100 per cent. The temperatures were 67° and 59° in the Adelphi Street factory, and 66° and 57·5° in the Clutha factory. The outside temperatures were 50° and 50° when I took it earlier in the morning. It would not be altered much.

4378. (*Chairman.*) What do you consider to be ideal atmospheric conditions for your work?—Probably I could describe it better by saying the months.

4379. Yes?—We find from the beginning of April on to May that the usual Scotch weather—slightly showery and a little damp feeling in the air—is the condition that we like best. In the latter half of the year, the autumn, we do not find the conditions quite as good, but they begin to get good about September again, but not so good as April and May.

4380. Supposing you could actually arrange your own temperature, what would you have?—Inside temperature?

4381. Yes?—65°. We aim at that.

4382. You have mentioned about the latter part of the year. In the very hottest days in summer have you experienced yourself any discomfort from great heat, or have your workers made any representations as to the great heat, or any discomfort from great heat? Of course, I know it must be so on certain days, but has it been so much felt as that a representation has been made?—We have never had any direct representation that way; but we have felt ourselves that the heat has sometimes been too great.

4383. Then you use your fans?—Yes, in the one factory; but, of course, those conditions do not obtain very often, probably on three or four days in two years.

4384. It would be perhaps a little difficult for you to answer, but I was going to ask you this: supposing that a standard of ventilation were fixed for non-humid sheds, how would it affect you? Naturally your answer would be it would depend what the standard was, and you probably might also say that without having had any experience it would be difficult to answer?—It would be very difficult to answer; but I know in the case of the Barrowfield factory where we do use the fans we find the use of them dries the air. We cannot use the fans except on very hot days, for that reason.

4385. It dries the air so much?—Yes.

4386. (*Professor Lorrain Smith.*) Did you say that you had never used humidity?—Never in my experience.

4387. You do not know of anyone here who has used it?—No.

4388. (*Mr. Roberts.*) How many people do you employ in this particular shed where you gave the cubic capacity as 649,790 feet?—279 weavers and 31 occasional hands; that will make 310.

4389. When you have had a very hot day in summer time, of course, you work those fans?—In Barrowfield, yes.

4390. Have you ever tried to work those fans when it has not been a hot day?—No, they were installed for that purpose.

4391. What do you imagine would be the result to your weaving if you were to work them on an ordinary day in summer time when it is not hot?—It would reduce the temperature too much.

4392. What would be the effect on the warps, on the threads?—They would get too crisp.

4393. And snap?—And snap.

4394. You would have more breakages, in other words?—Yes.

4395. Your percentage of breakages would go up?—Yes.

4396. Materially?—I have had no experience of that because we always stop the fans whenever we get our temperature like that.

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4397. (*Mr. Hartley.*) You have already told us that the material you use is the very best you can buy?—The very best.

4398. I should imagine that your sizing that you use is just a dressing for the purpose of weaving?—Just for weaving.

4399. The purest starch you can get?—The purest sizing we can get with good results.

4400. There is no addition of any chemicals to produce weight?—None whatever; in fact, the dressing is removed after the goods are woven.

4401. (*Chairman.*) Are no chemicals used to prevent mildew on the beams?—None whatever.

(*Mr. Roberts.*) We do not in Lancashire for pure size.

4402. (*Mr. Hartley.*) You use just some good talow or something of that nature to soften, to keep the thing soft and pliable?—Yes, very little.

4403. You do everything you can to keep the yarn in an elastic state?—Yes.

4404. Of course, you are not spinners; you would not know whether this is Sea Island cotton that is used in your yarn or the best Egyptian?—We do use pure Sea Island cotton for some of our best class of goods.

4405. That has a very long staple?—Yes, that is when we go to very high counts.

4406. (*Mr. Shackleton.*) The only question I would like to ask you is with regard to the health of the operatives. How long have these mills been going?—In the one case about eighteen years; in the other case about six years.

4407. You have probably operatives in the mill that have been working there practically all their time?—Yes.

4408. Have you any complaints about illness from the results of the atmosphere?—None whatever; we have never even heard the slightest representation from any of the workers as to the air of the factory.

4409. No complaint about feeling tired on a summer afternoon about four o'clock?—We have never heard any complaints.

4410. Do you work on the system of two full hours for breakfast and dinner?—Yes, but in the meantime we are on short time.

4411. But at the ordinary time do you think that is any advantage to the operatives having a clear hour for breakfast? In our Lancashire system we have an interval of from eight to half-past, and the operatives as a rule sit inside to their breakfasts for the half-hour. Your system is an hour for breakfast?—Yes.

4412. We understand from a previous witness that a large number of them go outside to their breakfast and get fresh air?—I do not know what it is for, but they go out.

4413. They do not stop inside the mill the whole hour?—No, but there is always a percentage of them that does that—people who come from a distance.

4414. You make no provision at your mill for dining rooms?—No. We make some provision for cookery.

4415. They have to eat the food inside the shed?—Yes.

4416. We take it there has been no complaint at all about the conditions of the shed so far as health is concerned?—Absolutely none.

4417. (*Mr. Thomas.*) Were you present when Mr. Wilson came?—Yes.

(*Mr. Thomas.*) Will you give us the figures again, Mr. Wilson?

(*Secretary.*) 67°, 59°.

4418. (*Mr. Thomas.*) Would you consider yesterday an ideal day for weaving, or was it too dry or too wet, or too cold or too hot?—As a matter of fact, I was only in the factory for about half-an-hour yesterday. It was a trifle too cold. The conditions were fairly good, except that it was too cold.

4419. Do you think it was too dry or too wet?—Neither, but slightly cold.

4420. Would you consider, then, that the humidity inside the shed was as much as you required for fairly good weaving?—No, we could have done with a little more.

(*Secretary.*) 62 per cent.

4421. (*Professor Lorrain Smith.*) How much more?—I am not an expert in that.

(*Mr. Hartley.*) In which shed was this?

(*Secretary.*) The Adelphi Street shed.

(*Mr. Hartley.*) Was that the first one you went into?

(*Secretary.*) Yes.

(*Mr. Hartley.*) Have you the readings for the second one?

(*Secretary.*) 66°-57·5°, corresponding to 60 per cent. humidity.

4422. (*Witness.*) There is one thing I would like to add.

(*Chairman.*) We shall be very glad to hear any statement.

4423. (*Mr. Thomas.*) Could this gentleman tell us whether the wood floor adds in any way to the temperature of the shed or makes it naturally warmer or colder, or pleasanter or what; what is the object of having a wood floor to the weaving shed?

(*Witness.*) Economy is the first consideration, I think.

4424. (*Chairman.*) What is there under the wood?—Asphalte.

4425. Where does the economy come in? Does it mean that asphalte wears out less quickly than this wooden covering?

4426. (*Mr. Shackleton.*) The asphalte is, I take it, simply ashes?—No; asphalte.

4427. (*Mr. Hartley.*) Is this the explanation? I asked a brother manufacturer as to this, and he said it was easier for the feet. They wear boots here. With us the workers mostly wear clogs. They are wooden boots shod with iron so that they can stand on the flags without discomfort. But I understood from the gentleman named that the reason you put this wood was to make it easier for the feet of the operatives?—I am afraid I cannot follow that. Of course, we have no experience of the operatives wearing clogs, but economy enters largely into it in my estimation, because it is very much more easily repaired.

4428. (*Mr. Roberts.*) You told us in your evidence that you used the very best of yarn?—Yes.

4429. Supposing you were to come down in the quality of your yarn, what would be the effect, do you think, under your present conditions?—If by any chance the yarn does come down—and occasionally we get a bad skip from Lancashire—the result is that we have either got to cut out the webs or make our weavers a large allowance to weave it out. We have that periodically; probably on two or three occasions in the year.

4430. Have you ever thought that with this worse material you could do better if you had greater humidity?—We see occasionally some of the older weavers trying. They will wet a little bit of rag and hang it on a string near a beam, or they will accidentally upset a can of water in the neighbourhood or something of that description.

4431. (*Mr. Roberts.*) Does that help?—It is supposed to help it. I think it does; in fact, it would not be carried out so often if it did not.

4432. (*Chairman.*) You were going to tell us something?—I was going to say that, in addition to the ventilators in our sheds, there is a considerable number of sheets of glass in sashes that do not come down; there is an eighth part clearance. If you were to hold a taper you would find there was a continual draught which would blow it out.

4433. Does that go right along?—Yes, every pane of glass is on that system.

4434. Does not that short circuit you?—This is put in largely to prevent condensation.

4435. It is an opening really between the glass and the sashes. That is a clear short circuit, and that would do very little. It would prevent condensation, but it would not ventilate the room. It might induce a certain amount of current?—We hold that it increases the ventilation.

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4436. (*Professor Lorrain Smith.*) No doubt, but it is a waste altogether in that you do not get full value for that ventilation?—If you clear this air out by means of it it helps.

4437. But if you could bring this entrance down to the foundations of the shed it would be better?—It would not suit.

4438. (*Chairman.*) The only ventilation you get here is from the induced current. Is there any point you would like to bring before this Committee. We have asked you a great many questions, but I daresay there

is a good deal we have not said or asked?—I am afraid I cannot offer any suggestion.

4439. There is no suggestion you would like to make?—No.

4440. (*Mr. Hartley.*) I do not know whether we are clear on one point about those fans. Are they exhaust fans?—Yes.

4441. (*Chairman.*) You never run them on the plenum system, that is, bringing the air in instead of out?—No.

The witness withdrew.

Mr. ROBERT LEAN, called and examined.

4442. (*Chairman.*) Are you a member of the firm of Messrs. John Lean and Sons?—Yes.

4443. What is your business?—We call ourselves fine muslin manufacturers.

4444. Cotton muslin?—Cotton muslin.

4445. How many weaving sheds have you?—We have one weaving shed.

4446. Can you tell us the cubic capacity of it?—I can: 434,956 cubic feet.

4447. And the number of looms?—The number of looms in the shed is 626.

4448. And the number of operatives?—Never more than 320.

4449. (*Mr. Roberts.*) That includes overlookers as well?—No. weavers; put in another dozen for overlookers; that is, including single loom weavers and learners. Perhaps you can make it fifteen, because there are always mechanics and odd men.

4450. (*Chairman.*) We have now the number of workers?—Yes, that is in our shed.

4451. What ventilators have you?—There are fanlights in the roof. There are 21 ridges, I think, and a fanlight to each, one alternately on each side—that is to say, a lifting ventilator like a skylight.

4452. In the bays?—On the top.

4453. Does it open up?—It opens out.

4454. You force it up, I suppose?—Yes. There are also, I may say, at one end of the shed fourteen windows with fanlights on the top of each which can be opened if required. There are eight doors, I think. One of them is a fire escape door that is not kept open. There are seven doors which can be kept open in summer.

4455. Have you any mechanical ventilation of any sort?—None.

4456. Can you tell us in practice whether those ventilators are kept open or whether, as a rule, they are shut?—In winter, as a rule, they are mostly kept shut. The roof ones in summer are nearly always open. To-day I happened to notice from a high building near (we have high buildings adjoining our shed) that there was one open in the very centre. Of course, the ventilation comes very largely through the doors.

4457. In winter you take it you get ventilation from the opening and closing of the doors?—To a large extent. One is kept open. The others are swinging to and fro and opened several times a minute.

4458. You really depend upon that for your ventilation?—To a very large extent.

4459. I should explain to you that one of the objects for which the Committee is appointed is to find out what temperature and humidity are necessary in each case for the manufacture of different classes of cotton fabrics. What do you consider an ideal temperature necessary for the manufacture of your goods?—It depends greatly on the outside conditions—65° to 70° as a general rule.

4460. 65° to 70° of temperature?—Yes.

4461. That would be a good temperature for manufacturing purposes?—Yes.

4462. Have you considered what relative humidity is desirable?—No.

4463. Have you ever considered the question of humidity at all for manufacturing purposes?—You mean artificial humidity?

4464. Artificial or natural humidity?—Not specially. We find that certain circumstances suit our work, circumstances which we have worked in for many years. I cannot give you any details as to the amount of moisture in the air.

4465. You have made no experiments?—No, we have made no experiments in that sense.

4466. Have you ever used any artificial humidity—I mean by the introduction of steam or atomised water or anything of that sort?—No.

4467. Have you on very dry days experienced any difficulty in weaving?—With an east wind or a north wind. With a wind from the north or east we find those winds have a slight effect, but we counteract that by keeping our temperature if anything a shade higher.

4468. How do you get that higher temperature?—The place is heated by steam pipes, and possibly we do it by allowing less ventilation so as to raise our atmosphere.

4469. You would close your ventilators?—On a day of that kind we want to keep more outside air out.

4470. On those days, seeing that there is a large number of workers and that there is practically no ventilation, and that those workers are breathing and perspiring, have you found the atmosphere become impure in the sheds?—I have no means of testing it. We do not test that.

4471. As far as your personal feelings are concerned?—Sometimes it is too warm for my personal feelings.

4472. But on those days have you noticed on going into the shed—probably you would notice it more than the workers themselves, because it does not matter if you are a long time in any atmosphere, you get more or less accustomed to it—have you noticed anything on going into the shed?—You feel it warmer.

4473. Do you appreciate any feeling of stuffiness or impurity in the air as far as your senses are concerned?—It is not so fresh with the temperature at 75° as it would be on other days; but it is a little difficult to answer that question, because it depends on circumstances so much. If it was a time when gas was lighted you would feel it a little stuffy.

4474. On a winter afternoon?—Yes, you would naturally with the gas burning; it tends to make it a little stuffy.

4475. Common sense suggests that. It is a question of degree. You know probably that in the humid sheds there is what is called a standard of ventilation; that there must be not more than 9 parts of CO₂ in 10,000 in the shed at any time?—Yes, I have heard that, but I have no experience whatever. I was never in a shed in which humidity was introduced.

4476. On the hottest days in summer have you had any complaints about excessive heat?—On the warm days in summer, and in summer generally we white-wash our roofs. I have asked my manager about that question. He has said that he is asked by weavers, "Is not it time it was done?" But the last summer we did not require to do that; we had no sun. In every other summer it has been done.

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4477. One of the terms of reference is as to what special arrangements, if any, are necessary in order to admit proper ventilation of dry weaving sheds without prejudice to the process of manufacture. Can you express any opinion on that point?—We find that the present ones work quite satisfactorily.

4478. Would not it be possible on days such as we have described to have a little more artificial heat in the way of radiators, and a little more pure air? I mean if you let in more air the room gets colder, and you would want more radiators, more heating pipes?—It is the dryness of the air in these east winds that affects it. The east wind dries up the air; therefore, you do not want so much air to come in of any kind. You want to keep your temperature about the same. I suppose that also refers to humidity, though I cannot speak definitely on that point.

4479. Your difficulty about ventilating these sheds is that you do not want air to come in?—We do not want excessive air to come in when cold and dry as in east winds.

4480. But you would not have much difficulty in ventilating on ordinary moist days?—No, I should say none.

4481. Would not it make it rather cold on a moist day such as we had yesterday for instance?—No, we found no difficulty.

4482. Supposing you were to have a few fans running on a day such as yesterday, would not it make the shed rather cold for weaving purposes?—It might tend that way, but I should think on a day like yesterday the shed would run to about 65°.

4483. Could not that be met by turning on more steam in the radiating pipes, making those a little hotter?—It might be so, provided the fans were not in excess.

4484. Do you know at all what the amount of humidity is that you get in your sheds on an average?—No, we have never made any experiments on that point.

4485. So far as the workers are concerned do you think that the physical exertion is greater when there is a large amount of humidity or on dry days?—You mean is there more work for them to do?

4486. Would they feel the work? Probably they would do the same amount of work on both days, but on which day would they feel most tired?—I could hardly answer that.

4487. (*Professor Lorrain Smith.*) You have just one class of fabric?—No, we have a very wide range.

4488. How wide is that range?—We use yarns from twenty-fours to one hundred and eighty.

4489. (*Mr. Roberts.*) To the warp?—No, twenty-fours pinn to one hundred and eighty; forties warp to about one hundred and sixty.

4490. (*Professor Lorrain Smith.*) It has been stated that if you use yarn which is not of such good quality you need more humidity; is that your experience?—We work with standard qualities; I could not speak with regard to humidity.

4491. You have no experience on that point?—No, I cannot say we have, because we do not experiment in humidity. If the yarn is not up to quality the workers complain.

4492. In the present conditions?—Yes.

4493. That is because it breaks, is it?—Yes, it is not so strong.

4494. (*Mr. Shackleton.*) I want to ask you about your answer to that question number one, that is, what temperature and humidity are necessary in each case for the manufacture of different classes of cotton fabrics. You say, so far as your mill is concerned, your present conditions are satisfactory?—That is so, from long experience.

4495. You neither require any increased ventilation or increased humidity; the present conditions are satisfactory?—Yes, for our class of work.

4496. You have no complaint?—Our manager said if it happened to be in the morning and the tem-

perature below 60, the operatives wanted more steam on because it was cold.

4497. No complaint in summer time about excessive heat?—No.

4498. (*Chairman.*) Yesterday may be taken as a normal day because we have the actual conditions?—I forget what the wind was yesterday.

4499. (*Mr. Shackleton.*) It was just a damp day.

4500. (*Chairman.*) You see, yesterday, we have both the temperature and the relative humidity, so we may ask if yesterday would be considered a typical day.

4501. (*Mr. Shackleton.*) We did not go into this weaving shed.

(*Witness.*) No, we had not the pleasure of a visit from you. We should have been pleased to see you.

4502. (*Mr. Shackleton.*) I think it might be advantageous if Mr. Wilson were to obtain the humidity in this shed, seeing that the witness has been here.

(*Witness.*) It has been done. I do not know what department did it, but the humidity was taken; an air test was taken.

4503. (*Mr. Thomas.*) I take this shed to be somewhat similar to the other shed we have seen; that is, a shed with pretty broad looms. The operatives run not more than two looms?—Not more than two. To tell you the honest truth I have not been into any other shed than my own.

4504. Your conditions are altogether different from what they are in Lancashire?—I fancy so, but I have not been in any Lancashire shed.

4505. (*Mr. Hartley.*) I was interested to hear one of the witnesses say that it is a habit to open the doors, to set the doors wide open at the meal times. Does that apply to your shed?—Our outside door is wide open.

4506. But at the breakfast hour and the dinner hour the doors are set open in some cases, and they find that to cool and ventilate the place in the hot weather?—In hot weather in summer the doors are open all round all day; but I may explain that in our shed they do not open exactly on to the street; we have a warehouse which runs the whole length of the shed outside; I should say it is about twice the width of this room; so that the air coming from outside passes through this. In the warehouse there may be a dozen men or so altogether.

4507. What I was trying to bring out was this: why it was necessary to do that in summer time. Is it because the operatives feel the oppression of the heat in the very hot weather?—The air outside is so very balmy and mild that it is not detrimental to the manufacture to do so, and it freshens the place.

4508. I may take it that you find your present means of ventilation quite sufficient for the hot weather?—Yes.

4509. The operatives do not suffer from oppression and the stuffiness even in the very hot weather?—I have not heard any complaints unless the sun was coming directly on them in which case we whitewash or provide blinds to the windows. Those are the only cases which the manager has reported to me.

4510. (*Chairman.*) You said there was some feeling of oppression when the gas was burning in winter?—The same as you have in any room.

4511. (*Mr. Hartley.*) You have not had any experience of fans or mechanical ventilation?—None.

4512. Do you find your operatives susceptible to draughts: do they object to open windows and open doors and ventilators, and so on?—I asked the manager that. He said sometimes some of the older women do. I think they are very much like the occupants of a railway carriage; you will hardly get them all to agree as to the opening of a window. It is difficult to please everyone, you understand.

4513. On the question of quality of work, you have told us the counts vary from forties up to one hundred and sixty in twist, in the warp. I suppose that means that you never drop below Egyptian cotton in quality?—We work American cottons.

4514. In forties?—Yes.

4515. In working that yarn produced from American cotton in forties counts do not you find a difficulty in

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the spring of the year when the east winds are blowing?—I have said that that is the worst time.

4516. Have you any serious difficulty in keeping up the quality of the cloth?—No serious difficulty. We keep our temperature if need be a little higher; we keep the place a little warmer. That is the tendency.

4517. Do you keep your ventilators open at those times?—Very seldom—you mean the roof ventilators.

4518. All the means where the air could get in?—No, they are very seldom open at that time.

4519. You keep them closed when those winds are blowing?—Yes.

4520. Why do you do that?—To keep out the cold air; to keep our temperature, as it were, up to a level point.

4521. May I take it, then, that the yarn is less elastic if there is more dry air?—It is more brittle.

4522. (*Mr. Shackleton.*) Arising out of that question I will ask you this: is it your opinion that that heat in a shed counteracts to some extent cold wind apart from any moisture you may get?—I think when you give additional heat it gives additional moisture, too.

The witness withdrew.

Mr. RICHMOND COCHRANE, called and examined.

4527. (*Chairman.*) Are you the proprietor of works in 47, Waddell-street?—I am a partner.

4528. What do you manufacture?—Cotton goods exclusively.

4529. How many weaving sheds have you?—We have no weaving shed. For weaving we have a five-flatted mill. It is not a shed.

4530. How many flats are there?—In the weaving mill there are five.

4531. Then there are five separate weaving establishments?—Separate weaving flats on the same staircase.

4532. They are separate and distinct each one from the other, one above the other?—Exactly.

4533. What class of goods do you manufacture?—Our chief manufacture is for India—muslins.

4534. Could you give us approximately the size or the cubic capacity of the rooms?—The weaving flats are pretty large. They are about 150 feet long by 50 feet wide by 12 ft., or thereabouts, in height.

4535. How are they ventilated?—With openings in the windows above.

4536. On either side?—On both sides. We have part of the top portion of the window opening inwards, with sides on it to prevent down-draught, and as near the roof as possible.

4537. You can open a shutter as much or as little as you like; it is pivoted so that you can get it at any angle, I take it?—Yes.

4538. Have you those in every window?—No, in every second window.

4539. On each side?—Yes.

4540. You say that those prevent direct draught?—Generally, the sides do, unless perhaps on windy days. On those occasions we shut it on that side and open it on the lee side.

4541. As a matter of practice do you find that these ventilators are kept open in winter?—They are, although perhaps they might be kept more open. In my opinion they might be kept fuller open.

4542. Have you any idea of what temperature you try to keep the place at?—I should think about 65°, perhaps from 63° to 68°; we have not tried it, but not above 70°.

4543. Have you considered the question of-humidity?—We have not.

4544. You know probably that in Lancashire, and perhaps all over the world, one might say, one finds artificial humidity introduced?—Yes.

4545. You have not tried it?—We have not.

4523. You think if you keep the shed warm it overcomes the effect of the dry winds?—It has that tendency.

4524. (*Mr. Roberts.*) During those times when you have those dry east winds your weavers will put wet cloths?—I cannot say I am aware of their doing that. That is a matter I should have to ask the manager about. He is more constantly in the shed. Personally, I am not aware of it being done.

4525. They do not attempt to deg the floor—water the floor?—No, I have not seen that done. There are fire pails of water all through the place, but passing through my shed I have not noticed that. They may do these things, but, personally, I have not seen it.

4526. (*Chairman.*) Is there any suggestion or anything you would like to lay before the Committee?—No, I do not think there is, except that our system is one which from long experience in our firm we have found work very satisfactorily. I do not think, personally, the firm have ever had any complaints from workers, and I think the manager has had very few, if any, at all. He told me, if any, it is usually when the mornings get a little cold. Existing conditions seem to suit our wide range of work very well indeed.

4546. You have not found it necessary?—We have not found it necessary, I may say.

4547. I take it from the class of goods that you tell us you manufacture it means very high class weft and warp both?—Not so very high class warp and weft, mostly for India; it is not so fine as some of the other manufacturers in Glasgow use.

4548. (*Mr. Roberts.*) What amount of size do you use?—We do not put on any weighting of any kind.

4549. Pure size?—Pure size to enable them to weave.

4550. (*Chairman.*) The atmosphere, as we all know, seriously affects weaving conditions. What is your experience in regard to dry winds, northern and easterly winds?—In northerly and easterly winds and in times of frost I think there is more breakage of the yarn, and I have had that complaint.

4551. What do you do to lessen that as far as possible?—We have nothing that we can do.

4552. Do you think that on those occasions the ventilators are shut?—Naturally and probably the weavers would have the ventilators more closed in cold weather than in hotter weather.

4553. That would mean, of course, that by closing the ventilators there would be greater heat and greater moisture in the room from respiration and perspiration?—It might be so.

4554. Have you noticed on any occasions what has been the condition of the air when the ventilators are closed like that?—In reference to the dryness I have not particularly noticed.

4555. Dryness and purity. Is there a feeling of stuffiness?—Sometimes there is, and I am rather particular about that. I get the weaving master to open the windows as much as possible.

4556. What will be the state of things, say, about four o'clock on a winter's day? Have you the electric light?—We have incandescent gas lighting.

4557. What would be the condition of the air in those rooms, say, on a November or December day about four o'clock in the afternoon with reference to the purity of the air?—We have personally taken no tests in that way.

4558. But from your own feelings?—I can only say that formerly, before we altered the ventilation a good many years ago we had complaints. Now we have no complaints. In reference to the dryness I cannot say that you notice much difference in the flats, because the flats are heated with steam.

4559. I suppose there are radiating pipes?—Yes, they are about 7 feet above the floor, two lengths of 4-inch cast-iron pipes.

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4560. Have you had any complaints at any time from your workers in regard to excessive heat?—We had before we altered the windows. Formerly we had small louvre panes which might sometimes be closed up. We had complaints, then, but we have not had any since.

4561. Supposing it were proposed to have a standard of ventilation for non-humid sheds as for humid sheds, what would you say about it—not necessarily the same standard, but it has been represented to the Committee, and actual observations have shown that many humid sheds in different parts of the country have conditions in which the carbonic acid goes up to 20 and even 30 parts in 10,000. That is so under certain conditions, and it is considered rather detrimental to health, and has given rise to the consideration whether there should be a standard of ventilation for non-humid sheds?—Would you like to know what I have to say about that?

4562. Yes; what would you say about that?—I understand for one thing that the air of Glasgow is rather high in carbonic acid, so perhaps there should be a little more allowance made for Glasgow.

4563. Naturally, it would be so much above the outside air?—Yes, I fancy so; but I may say I have just recently read Dr. Haldane's Report, and I think it is a very interesting report in that respect. I think all manufacturers should get some hints from it; I know I have.

4564. Was that Dr. Haldane's Report that was published some years ago?—Yes.

4565. There has been a recent one?—That is more on mechanical ventilation.

4566. He has also gone into the question of the physical effect of working in high moist temperatures, and if you are interested in his reports it might be rather well for you to get that. However, you read that report, and you are favourably disposed to the recommendation that he made?—Yes, I think so, as far as it can be practically and reasonably carried out.

4567. I think that it was 12 parts of CO_2 in 10,000?—I do not know about that. I do not know how that would stand. I am only speaking generally. That might be rather low for Glasgow.

4568. You have read Dr. Haldane's Report on ventilation?—I have.

4569. I will read you a paragraph from his second report and ask you if generally you would agree to the recommendations. "As regards impurity from persons and lights the legal standard proposed by this Committee in its first report was such as would prevent the proportion of CO_2 from respiration or combustion from rising beyond 12 volumes per 10,000 of air during daylight or beyond 20 volumes at night with gas burning." That was his proposal. Perhaps you would kindly tell us what you think about that proposal?—I have never taken the carbonic acid in the air, so I cannot say. That might be, as I say, rather too low for Glasgow. I am speaking generally when I say that the first report was very interesting to me, and I think very ably put. It might be reasonable, but I cannot say with regard to the number of volumes of CO_2 .

4570. Then I take it that although you agree generally with the intention of the report, the technical details are difficult to answer about without actual experiment?—Yes.

4571. (*Mr. Roberts.*) How many operatives have you in each flat?—In the weaving flats we have probably about 65.

4572. Will that include overlookers?—No, there will be perhaps two or three men besides that.

4573. 68 persons?—Yes, it might be 68.

4574. (*Mr. Shackleton.*) The number of looms in each flat would be what?—Fully 150.

4575. This is a question which we have to ask: what temperature and humidity are necessary in each case for the manufacture of different classes of cotton fabrics? We are asked to get information upon that point. As a manufacturer, I should like to know whether, in answer to that question, you would say

that your present conditions are satisfactory from the point of view of manufacturing your particular classes of goods?—On the whole, I would say yes, but it might be improved.

4576. That is rather important if you say it might be improved; in what direction?—We have no information on that line—I mean in the sense of moisture. We have not tried it. If there was frosty weather or much prevalence of east wind it might be improved, because we have had complaints of the yarn on those occasions.

4577. I understand you work in rooms, not in the open shed, and all the light is side light?—Side light.

4578. And as to the ventilation the cubic space would be probably rather less than the ordinary shed, would not it?—I should think it would be rather less.

4579. Have you had any complaints from the operatives in the winter or in the summer on account of the stuffiness of the place?—I have not.

4580. Even in a hot summer's day?—No, possibly a flat is cooler, because you have not the direct rays of the sun on the glass.

4581. You think that method of opening a window on the contrary side to the wind is a method by which you get a freshness of air without the draughts, and that is satisfactory?—I think so. Since I have read Dr. Haldane's Report I have perhaps increased the number of windows opening in that way so as not to have them too much open in the case of a draught. When there is so much wind it is not necessary to have them open so much, because so much more air comes into the room. We have had great improvement since we did that. We have had great improvement, too, since the incandescent lighting. There is improvement in the burners, and they are higher up.

4582. (*Mr. Roberts.*) The workers are satisfied from a health point of view, and you are satisfied from a manufacturer's point of view?—Generally, I should say so.

4583. Have you ever used any artificial humidity of any description?—Not, except locally; at one time we used it on what we called a roll. We have given it up for some years past. There were objections to it.

4584. Did your weavers ever put wet cloths on the beams?—They sometimes do with those conditions of dryness in the atmosphere. If there was much of that it might be desirable to do a little, as I have said already. Of course, we do not weight our fabrics in sizing.

4585. In certain circumstances you will find certain warps do not weave so well?—Not so well.

4586. Then the weavers are at liberty to put wet cloths on?—I noticed them do it.

4587. With what results?—They think it better.

4588. Probably you think so too?—Yes.

4589. (*Mr. Roberts.*) That is what we think.

4590. (*Mr. Thomas.*) Can you give us the temperature of the shed?—I should say just now it will be about 65°.

4591. Do you reckon that a very nice temperature, or is it too low?—I think it is a pretty fair temperature.

4592. (*Mr. Shackleton.*) It is interesting to notice here that this workroom gives more cubic space per person than a shed?—I calculate there is about 1,300 cubic feet.

4593. (*Mr. Shackleton.*) 1,323, including every operative.

4594. (*Mr. Thomas.*) In Lancashire in sheds of that description we have a lot of complaints with regard to stuffiness. Workrooms similar to yours seem to be going out of date on account of the ventilation. Have you much complaint of bad ventilation?—We have not.

4595. You say that the roof is about 12 feet high?—11 feet or 12 feet high.

4596. (*Mr. Hartley.*) You say you agree with Dr. Haldane's conclusions?—In general. I think his report is very interesting.

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4597. You do not know anything about his conclusions with regard to the CO₂ test?—As far as the quantity of it I cannot say. I have no knowledge of that.

4598. You do not know at all what it would mean to comply with a standard of 12 volumes in 10,000?—I would not say that.

4599. You have no idea whether your present ventilating arrangements would be sufficient?—They might not, possibly.

4600. I want you to understand that you have not committed yourself in any way to answer in that question with regard to the CO₂ test?—That is as to the quantity, but I have some idea that in the Glasgow air it is pretty high, and he fixes the same amount all over the kingdom.

4601. Still, there is always a test taken of the outside air, and allowance is made for the purity.

4602. (Mr. Roberts.) I thought Mr. Hartley would have led up to the point. If a standard, say, of 12 volumes had to be attained in your particular rooms you would have to have fans that would move 2,000 feet of air per hour per operative employed to get a standard of, say, 12. What effect would that be likely to have on your weaving?—You say we should require to have fans, not natural ventilation?

4603. Yes?—I do not read Dr. Haldane's Report in that way at all. I do not admit that.

4604. (Professor Lorrain Smith.) 1,250 cubic feet of air per person per hour.

(Chairman.) He says to maintain that standard it would require that?

(Professor Lorrain Smith.) Yes.

4605. (Chairman.) Does not the size of the room come in?

(Witness.) If I might interrupt, I may say the reason I am basing my answer is because of two or three quotations. He says on page 112: "Natural ventilation with regulation and attention by one man responsible in each room is easy enough"; that is natural ventilation. Then at page 105 he also says, "Conditions of factory rooms vary very greatly; consequently any uniform system of ventilation for all is out of the question." Then at page 111 he says, "Excellent results obtainable without mechanical ventilation."

4606. (Mr. Roberts.) I think you have misunderstood. We cannot exactly realise what Dr. Haldane means unless we read the context; but, from your experience, that is what you have to do.

(Chairman.) But then, you see, this gentleman is giving his evidence.

(Mr. Roberts.) I only ask what effect he thought fans would have on his weaving if he had to put fans in.

(Witness.) They would have to be well arranged, otherwise there would be draughts.

4607. (Mr. Shackleton.) There is a paragraph here on the point. You know probably what Tobin tubes are?—Yes.

4608. This is what he says: "Where ventilation is mainly dependent on this plan, it is essential that the openings should be sufficient in number and cross section to perform their work even on warm days."

(Mr. Roberts.) You must read the context before you can arrive at any conclusion.

(Chairman.) But I think we have before us one particular room, and it would be difficult certainly for the witness to say, and I do not think we could ourselves say exactly how much ventilation would be required to produce a certain standard right off. I do not think we ought to get any statement of that sort on our evidence unless one is prepared to substantiate it.

(Mr. Hartley.) Would it be of interest to have some CO₂ tests made in these rooms?

(Chairman.) Yes, I think that it would be very desirable, and perhaps that might be one of the things to be done by us during the recess.

(Witness.) The records of our flats were taken by the inspectors some time ago.

(Chairman.) Then we shall have the records.

4609. (Mr. Shackleton.) You told us, Mr. Cochrane, the number of windows you had opening in each room. What was the number—say, on an ordinary summer's day?—Half the number of the whole of the windows.

4610. What is the width of the opening; what is the square measure of it?—The width of it probably, about 2 ft., and then it opens inwards.

(Mr. Thomas.) Then you would get about 2½ square feet at the top.

4611. (Mr. Hartley.) Does Mr. Cochrane mean that the size is only 2 ft. square?

(Witness.) No, it is the centre portion of the window that we have opened.

4612. (Chairman.) It is also capable of being adjusted. The thing is hinged, and goes up and down, and you can adjust it?—Yes, you can.

4613. And you can also prevent draught by closing it in at the sides?—Yes.

4614. (Mr. Shackleton.) The witness has apparently been reading this report of Dr. Haldane in which Dr. Haldane suggests there must be at least one square foot of free outlet for every six persons in order to get 2,000 cubic feet per person.

(Witness.) I do not just remember that, but that is what we have. I am not prepared to say that our ventilation is perfect, but I am saying it is very much better than it used to be. I would perhaps go further and open every window since I have read that report. I have got a great deal of information myself from that.

4615. (Mr. Thomas.) Since reading that and putting into operation what you think is necessary, you have not had any complaints from the operatives with regard to draughts?—I would not get them. They would ask the tenters not to open their windows so much probably.

4616. (Mr. Shackleton.) You have these arranged on both sides of your room?—Yes.

4617. You open and close them according to the wind?—Yes.

4618. (Chairman.) I want to be sure about the system. What is running in my mind is that it is very much the same as you find in all our board schools. It is shut in at the sides, so that the air goes upwards and you do not get direct draughts?—That is right.

The witness withdrew.

TENTH DAY,

Friday, April 10th, 1908.

At Glasgow.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).Mr. WILKINSON HARTLEY.
Mr. T. ROBERTS.Mr. D. J. SHACKLETON, M.P.
Professor LORRAIN SMITH.
Mr. D. R. WILSON (*Secretary*).

Miss L—— H——, called and examined.

4619. (*Chairman*.) Are you a weaver?—Yes.
 4620. Where do you work?—At ——
 4621. How long have you worked there?—Seven years come the fair.
 (*Mr. Roberts.*) That is July.
 4622. (*Chairman*.) I daresay you feel the shed very comfortable—is that so?—Yes.
 4623. You always feel it just nice and comfortable?—Yes.
 4624. Do you ever feel any draughts?—No.
 4625. Have you ever complained of the heat?—No.
 4626. You have no excessive heat to complain about?—No.
 4627. Or is it ever too cold?—No, it is gey mild.
 4628. About weaving, do you find any difference on dry days and wet days?—No.
 4629. It weaves just the same whether it is wet or whether it is dry?—Yes.
 4630. On a foggy misty day is the weaving a bit easier than on a dry day like this?—No, just the same.
 4631. Have you been quite healthy and well ever since you have been there?—Yes.
 4632. Then you have nothing to complain about?—No.
 4633. That is good. I wish we were all the same.
 4634. (*Professor Lorrain Smith.*) Is there much illness in your mill?—No, there is not extra much with the people working round about me.
 4635. Are people off work often?—No.
 4636. You are not off work?—No.
 4637. (*Chairman*.) About the clothes. Of course, you go to work in the winter and then you put on some warmer clothes for coming away in?—A thicker blouse in winter.
 4638. You hang up your coat or shawl or whatever it is?—Yes.
 4639. You hang it up when you go to work, and then put it on again when you go outside?—Yes.

4640. So that prevents you catching cold?—Yes.
 4641. (*Mr. Hartley.*) Is it all white cotton that you are working?—Yes.
 4642. Have not you noticed when it is frosty weather that you have more threads break?—Sometimes there is, and sometimes there is not.
 4643. You have not noticed any difference?—No.
 4644. When there is an east wind blowing?—No.
 4645. Have you any idea how many threads break in an hour?—It depends on what kind of yarn you get.
 4646. But you have not noticed any difference between frosty weather and wet weather?—Sometimes when it is frosty the yarn snaps.
 4647. (*Professor Lorrain Smith.*) It does not do it on the damp days?—No.
 4648. (*Mr. Roberts.*) That is, it weaves better when the weather is damp?—Yes.
 4649. (*Mr. Hartley.*) Do they open the windows?—No, but the ventilation is opened.
 4650. Are there windows in the roof?—Yes; they do not open them.
 4651. Do not they open them in hot weather?—No, the ventilation is enough.
 4652. In very hot weather have not you noticed that it gets close, stuffy?—Ay.
 4653. (*Professor Lorrain Smith.*) It gets stuffy on the hot days, does not it?—Yes.
 4654. Is it very disagreeable then?—Ay.
 4655. In the afternoon?—Ay, in the afternoons specially.
 4656. (*Mr. Hartley.*) Do you ever feel like fainting?—No.
 4657. You never feel overpowered with the heat?—No.
 4658. (*Professor Lorrain Smith.*) You can work just as well as ever you worked in spite of the stuffiness—you can weave as much?—Yes.
 4659. (*Chairman*.) How many looms do you look after?—Two.

The witness withdrew.

Miss E—— S——, called and examined.

4660. (*Chairman*.) Are you a weaver?—Yes.
 4661. Where do you work?—At ——
 4662. How long have you worked there?—Two years in March last.
 4663. How many looms do you look after?—Four.
 4664. (*Professor Lorrain Smith.*) There are not many look after four, are there?—They nearly all look after four in the coarse end.
 4665. In the fine end they have how many?—Two.

4666. (*Mr. Roberts.*) You are on the coarse side?—Yes.
 4667. (*Chairman*.) Have you enjoyed good health since you have been there?—Ay, I cannot complain.
 4668. You have nothing to complain of?—No.
 4669. Do you find that the work is comfortable to you generally?—I have nothing to complain of so far.
 4670. You like the work?—I have never done any other kind of work.

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Miss E—S—.

4671. (*Professor Lorrain Smith.*) What did you do before you went to the mill?—Just after I left school I went to the mill.

4672. (*Chairman.*) Do you ever find it too hot—do you ever feel any discomfort from the heat—does it make you feel uncomfortable?—Ay.

4673. (*Professor Lorrain Smith.*) When will that be? (*Chairman.*) Is it in the summer?—Ay, in the summer.

4674. In winter do you ever feel it?—Very seldom.

4675. We will take the month, say, of November or December, about three or four o'clock in the afternoon, when all the gas is burning; do you feel it hot then?—Yes.

4676. Does the air get bad—does it make you feel a little bit uncomfortable, or do you notice it at all in those days in the winter afternoons when all the gas is burning—you said the room gets a bit hot?—Yes.

4677. Does that make you feel uncomfortable when you are at work?—Sometimes it does.

4678. (*Professor Lorrain Smith.*) Is it bad?—Sometimes.

4679. What do you feel like—not very ready for work?—Yes.

4680. You would like to stop?—Ay.

4681. You feel tired?—I feel tired gay often.

4682. (*Mr. Roberts.*) That is not on account of this gas, is it?—No.

4683. (*Chairman.*) Your work of looking after four looms is pretty heavy?—I should think so.

4684. But it means more money?

(*Professor Lorrain Smith.*) You get better wages than if you have two looms?—If you had two looms you would make nothing. You have to have four if you want to earn anything.

4685. (*Chairman.*) That, of course, means hard work?—Ay.

4686. (*Mr. Roberts.*) You could not live on the earnings from two looms?—No; it is 6s. off two looms. I have been just three weeks on those four looms.

4687. What had you before?—Three. I lifted 10s. a week off the three.

4688. Are you on full time?—Yes.

4689. You are a full-time worker now?—Yes.

4690. (*Professor Lorrain Smith.*) You will not get more to look after?—No.

4691. Have you learned the whole thing in two years?—Yes.

4692. (*Chairman.*) Have you been away ill at all since you went to the mill—have you been in the doctor's hands at all?—No.

4693. They do not go away from the mill much for illness; the weavers are not much off, are they?—You can go away whenever you like.

4694. But do they go away because they are ill? They have to work hard, but it does not do them any harm, does it? You do not notice them getting ill?—No.

4695. (*Mr. Hartley.*) You are on coarse twist, you say?—Yes.

4696. Do you know what counts they are?—I do not know what you mean.

4697. (*Mr. Roberts.*) What is the difference between the coarse and the fine?—The fine end is better paid; it is particular work. They have two looms in the fine ends and four in the coarse end.

4698. Is there any difference in the width of the looms?—In the fine ends they are broad.

4699. (*Mr. Hartley.*) Have you noticed when the weather is cold, when there is frost or there are strong winds that you have more breakages?—Yes.

4700. You have?—Yes.

4701. (*Mr. Roberts.*) You have fewer breakages when the weather is damp, is that it?—Ay, when it is misty.

4702. (*Mr. Hartley.*) Do you remember two years ago in the summer—you would be working at this place then?—Yes.

4703. In 1906, at the end of August, there was some very hot weather; the mill would be working then, would not it? Your holidays are in July. Do you remember that very hot time?—I do not.

4704. Then you never feel uncomfortable on account of the heat?—Sometimes I do.

4705. (*Chairman.*) Is there anything you have to complain about?—No.

4706. You would rather someone had left you a nice little fortune, and you had not to go to work—that would be better, would not it? But as you have to go to work is there anything you have to complain of about the work?—No.

(*Chairman.*) That is a very happy state of things.

The witness withdrew.

Miss A—J—, called and examined.

4707. (*Chairman.*) Are you a weaver?—Yes.

4708. Where do you work?—

4709. How long have you worked there?—For six years past.

4710. Have you, as a rule, enjoyed good health since you have been working?—Yes, very.

4711. You have not been in the doctor's hands at all?—Well, once.

4712. Perhaps that was nothing to do with your occupation?—No, it was not.

4713. Do you find the room in which you work comfortable, as a rule?—Yes, it is very comfortable.

4714. Do you sometimes feel the heat oppressive?—Well, in very hot weather, in the summer time, it is very close.

4715. In the very hot weather in summer you feel it oppressive, and I daresay it makes you feel a bit tired at your work?—Yes, it does.

4716. In the winter afternoon, about three or four o'clock, I suppose, you have gas lighted?—Yes.

4717. When all that is burning does the room get a bit stuffy and hot?—Yes.

4718. Does it make you feel a little bit tired?—Yes, it makes us a little bit tired sometimes.

4719. You have a sort of tired feeling, and I daresay the work seems to be a bit harder then?—Yes, we cannot get through it the same.

4720. How many looms do you look after?—Two.

4721. (*Mr. Shackleton.*) Are they wide looms?—Yes, broad looms.

4722. Fancy looms?—Lappets.

4723. (*Mr. Roberts.*) Do you remember what ventilation you have there?—Our shed is very well ventilated.

4724. (*Professor Lorrain Smith.*) You air it?—There are ventilators in the roof, and they are opened very often.

4725. (*Chairman.*) Do you get any draughts?—There is one of the ventilators above me; there is a wee bit draught comes down there; sometimes it is very bad in stormy weather.

4726. Then I suppose in stormy weather you shut it up?—Yes.

4727. Then the air gets bad, I daresay?—Yes.

4728. I suppose it comes right down on top of you?—Yes.

4729. Take a wet misty day and a dry day with the wind in the east—a cold dry day: do you find any

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difference in the weaving?—I cannot say I find any difference.

4730. Take a dry day first: would the yarns break more?—No, I think it is worst in frost.

4731. They break more on a cold day?—Yes.

4732. Does the state of the weather make any great difference to you?—No, I cannot say it makes any great difference.

4733. Evidently it is not very appreciable.

(Mr. Shackleton.) Does it make much difference to your wages?—Yes, I think it does.

4734. (Chairman.) It does make a difference to the wages?—Yes.

4735. You are a piece-worker?—Yes.

4736. In the cold frosty weather you would get less money?—Yes, the work goes worse then; we cannot get on as well.

4737. (Professor Lorrain Smith.) How much less would you get in a frosty week, say?—We might work a piece less; that would be about 3s.

4738. (Chairman.) I think you said you looked after two looms?—Yes.

4739. In very cold frosty weather you would lose as much as 3s. in a week?—Yes.

4740. How often has that happened since you have been there?—I cannot say how often; it has been pretty often, anyway.

4741. (Professor Lorrain Smith.) Two or three times each winter?—Yes, since the strike we have lost a lot of time.

4742. (Mr. Shackleton.) That is the strike of the tenters?—Yes, but in previous winters we have.

4743. (Chairman.) We are not at present going into the wage question. We are going into the conditions

of the weather. Have you lost anything in consequence of the weather?—Sometimes we do lose a little on account of the weather.

4744. The yarns break more in frosty weather?—Yes.

4745. Is there anything which you think of in the condition of the room or the ventilation or anything of that sort that you would suggest could be done and that you would suggest for your comfort or the comfort of the other weavers in the room?—I think in the very hot weather all the ventilators should be opened.

4746. What would you do in those winter days when the gas is burning? Would you have the ventilators open? I suppose if you open them the cool air would be very uncomfortable?—Yes.

4747. But do you think it would be better, supposing they were opened, but the air was warmed as it came in?—That would make a big improvement.

4748. (Mr. Shackleton.) I should like to ask you this: taking the conditions generally, do you know of yourself whether operatives are absent because of illness on account of the conditions in the shed?—I must say I have worked in other places, but I have never worked in a healthier place, and the girls about me are very rarely off.

4749. You do not know of any complaints because of the condition of the shed?—No, I do not.

4750. Do you know whether the weavers have complained to the doctors when off because of the conditions of the shed?—I cannot say that about —. Of course, I have worked in other places.

4751. You have worked at — six years, about?—Yes.

4752. And it is satisfactory?—Yes.

The witness withdrew.

Miss M—— E——, called and examined.

4753. (Chairman.) Are you a weaver?—Yes.

4754. How long have you been a weaver?—Twelve years.

4755. Where do you work now?— —.

4756. How long have you worked for that firm?—Twelve years.

4757. You have worked all the time for that firm?—Yes.

4758. Have you, generally speaking, enjoyed good health?—Yes.

4759. Have you been away ill during those years?—No, only slight illnesses, colds and that.

4760. Nothing serious, nothing brought on by your occupation?—No.

4761. Do you find the condition of the shed comfortable for the working?—Yes, I think it is a very healthy shed.

4762. I suppose at times it gets very hot?—Sometimes in the summer time it gets a bit hot, but nothing extra.

4763. There are ventilators there?—Yes.

4764. In the summer are those ventilators kept open properly?—Yes.

4765. We will take one of the afternoons in winter when the gas is burning, does the room get hot then?—It gets hot, but not too hot; nothing uncomfortable.

4766. Of course, with all the gas burning, I suppose in the winter the ventilators are shut as a rule?—No, I think they are always open.

4767. With all the gas burning in the winter does the air get a bit stuffy?—No, because they open the doors in the shed.

4768. How many looms do you look after?—Two.

4769. Do you notice any difference on warm or wet days and on dry days in the weaving?—Sometimes, if

it is dry for a time the yarn does not go so well; but generally we have plenty of rain here.

4770. I suppose you are a piece-worker?—Yes.

4771. When you get dry weather, say, for three days, does it make a difference in your wages at the end of the week?—It does not make much difference in the wages, but you have a little more yarn to tie.

4772. Do you get the same output?—Yes, I cannot say I have ever lost anything.

4773. (Professor Lorrain Smith.) Have you to work harder?—You have a little more yarn to tie, but not much harder work, nothing to speak of.

4774. You do not lose any big sum out of your weekly wage?—No.

4775. (Chairman.) Could you make any suggestion that would add to the comfort of the weavers in the shed in the way of ventilation, or anything of that sort?—No, I could not say. I have never worked in any other shed but that.

4776. You are quite satisfied with your conditions there?—Yes, I think it is a very healthy shed.

4777. You do not hear of other weavers going off ill? No, nothing serious.

4778. Everybody is ill now and then, but nothing serious, nothing exceptional?—No.

4779. (Mr. Hartley.) Do you remember the summer two years ago—do you remember August. It would be after the Glasgow Fair—do you remember that hot spell of weather?—Yes.

4780. Did you notice whether there was discomfort then?—No, because they whitened the roof of the shed.

4781. And also the other part of the roof did they whitewash?—I could not mind when it was whitened, but I know the outside of the windows was done, and it makes the place cooler.

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4782. (*Professor Lorrain Smith.*) And the slates, too?—I could not say that. What I saw was the glass.

4783. (*Mr. Hartley.*) Do you not remember any of the weavers being sick or fainting with the heat?—No, because the doors are always kept open in the summer time in the shed.

4784. Do you remember that hot spell when there were three or four days of very hot weather?—Well, I could not say that I remember it.

4785. You would have remembered it, I think, if you had felt much discomfort, would not you?—I think so, but I cannot mind that time.

4786. (*Mr. Shackleton.*) Of course, you remember the windows being whitened?—They are done every summer.

4787. (*Mr. Hartley.*) Then the ventilation that you had was sufficient for that very hot time as far as you remember, was it?—Yes.

4788. (*Chairman.*) Do you take your meals in the shed?—No.

4789. Perhaps you live near the works?—Yes, I live near the works.

4790. Do any of the girls take their meals in the shed?—Yes, those that have long roads to come.

4791. Those who have their homes a long way off take their meals in the shed?—Yes.

4792. (*Mr. Shackleton.*) Have you always worked on the present system of an hour for breakfast and an hour for dinner?—Yes.

4793. Do you like that system?—I like it well enough.

4794. Are you able to cook your own food at home by having an hour?—It is always cooked for me.

4795. (*Mr. Hartley.*) Would you like a half hour for breakfast rather than an hour and to stop at half-past five instead of six?—That would not be very suitable, because there is no good going off home for half an hour.

4796. You would rather have more time and go home?—Yes.

The witness withdrew.

Miss J— C—, called and examined.

4797. (*Chairman.*) Are you a weaver?—Yes.

4798. How long have you been a weaver?—About two years and a half.

4799. Where do you work?—At —

4800. Have you worked there all the time?—Yes, nearly all the time.

4801. Will you tell us if you have enjoyed good health as a rule?—I have had better health at — than ever I had.

4802. Were you engaged in any business or occupation before?—I was in Cranston's Tea Rooms.

4803. A waitress?—No, I was downstairs in the kitchen.

4804. But you find that you have enjoyed better health in the weaving shed than you did in Cranston's?—Yes.

4805. (*Professor Lorrain Smith.*) How long were you in Cranston's?—I was there about eight or nine weeks, just before I went to —.

4806. (*Chairman.*) Had you done anything before?—No, I had just been in the house before.

4807. Do you find the shed in which you work comfortable, I mean do you find it sometimes too hot or too cold?—It is very often too cold.

4808. What time in the day do you find it so?—Of course, that is in the morning.

4809. Is that in winter?—Yes, in the winter.

4810. As the day goes on it gets hotter?—Yes.

4811. Is it comfortable as the day goes on?—I have no fault to find. I always find it pretty comfortable.

4812. And in the winter days with the gas burning, in the winter afternoons do you feel it hot?—I cannot complain about it being too hot.

4813. Does it feel a bit stuffy with the gas burning?—No, I cannot say it feels stuffy.

4814. You find nothing to complain of?—No.

4815. There are ventilators?—Yes.

4816. As far as you can tell the air you breathe is comfortable?—Yes.

4817. It does not make you feel oppressed or tired?—No.

4818. At any time of the year do you feel the heat so great that you feel exceptionally tired as if you wanted to stop work?—I cannot say as I do.

4819. You feel you get through your day's work comfortably?—Yes.

4820. How many looms do you look after?—Two.

4821. Do you find any difference on cold days and dry days—is the work harder than when the air has got a lot of moisture in it—a misty day?—I cannot say that it is any harder.

4822. Do not the threads break off on dry days?—Well, sometimes on a cold day the yarn nips the beam.

4823. The yarns break?—Yes, in the morning it is worst.

4824. You said it was colder then?—Yes.

4825. Does it make any difference in your wages?—No, it does not make much difference in my wages.

4826. It just means a bit harder work?—It just means you have to work constantly.

4827. Is there anything that you would suggest that would make your shed more comfortable to work in?—I cannot say that I can find any fault.

4828. You are quite comfortable where you are?—Yes.

4829. We gather you are quite satisfied. If there is anything you would like to suggest we should be very glad to hear it?—I cannot say I have anything I can suggest.

The witness withdrew.

Mr. JOHN CAMPBELL, called and examined.

4830. (*Chairman.*) You are the manager, I think, of —what firm?—William Strang and Son.

4831. How long have you been in those works?—Twenty-eight years.

4832. Then you have, of course, naturally some knowledge as to the conditions under which the people work—full knowledge?—Yes, as far as the ventilation

and the heating and the regulations and other things in connection with the work.

4833. We have been to the works, and we know what ventilators you have. Have you in your experience found that the atmosphere of the shed is oppressive or uncomfortable at any time?—No, except in what they call very dark weather when the gas is lit; it is a

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little oppressive then; and even then I always look after the ventilation, and the girls look after it for themselves.

4834. Take such an afternoon as we have been asking about, a winter day in the afternoon in November or December, perhaps a misty day, your ventilators are opened?—Yes, we keep them open

4835. But the circulation of the air would not be so great, the air would be heavy to move?—It is wonderful how it moves; there is a current at the top. We have windows at each end of the shed besides the ventilators in the roof and at the end.

4836. Even under those conditions you have felt the shed a little bit stuffy?—Yes, I would say it was hot.

4837. In addition to the question of heat, is there a feeling that the air that has been breathed over and over again is a bit stuffy, or a feeling that you can almost smell the air?—No, I cannot say I have ever felt any great feeling of that kind in the shed except it was warm, and then that was the complaint; there was no complaint of being stuffy, or of stifling air, as the girls call it.

4838. Do you know if any tests have been taken in your shed as to the purity of the air under those conditions?—Not with me.

4839. You do not know?—No, the heat is the only thing that I try to recollect—to bring down the heat.

4840. You have no knowledge as to the purity of the air; you cannot say by experiments or analyses of air?—No, I have never done any tests of that kind.

4841. Do you know anything about the moisture in the shed?—No, except I know the feeling when it is damp, and I know when it is dry. In the summer time we have it dry. In the wet weather we know it is moist; there is a feeling that it is a damp day.

4842. Judging by your feelings there are some days when the air is much drier in the shed than on other days?—Yes. The fact of the sun beating on the roof sort of dries it up; we know it even by the speed; the looms catching on the belts. If it was dry on Saturday and wet before Monday we can feel that the place is damp, but not disagreeable.

4843. When you believe the shed to be damp, does the work seem to be more oppressive to the workers than on the dry days?—No, I could not say it does. I cannot say it is more oppressive. It is a thing I never heard them complain much about. We have so little of people feeling that way that my attention has never been drawn to it.

4844. From a weaving point of view, what are the conditions that you like best for weaving?—A little damp for the class of work that we have.

4845. What temperature?—Between 67° and 70°.

4846. You would keep it at that if you could?—Yes, and generally do. I have thermometers over the place, and those that look after the steam regulate it according to them. It is a thing that I take regular notice of myself, and there are instructions to the men that look after the heating of the place to do the same.

4847. I think you have told us how many years you have been there?—28 years.

4848. What impression have you formed as to the health of the workers as compared with the workers in other occupations?—Healthy. I consider that our place and our workers are above the average as to health.

4849. You consider them a healthy lot of workers?—Yes, the nature of their occupation is to me what I call a healthy occupation for the girls, an open shed, and they are always on the move.

4850. (Mr. Hartley.) Do you remember the end of August eighteen months ago, in 1906?—It was hot.

4851. Specially hot?—Yes, it was hot.

4852. You remember that heat wave?—To say that I remember the particular time, well, I could not.

4853. Do you remember there was a heat wave?—Yes, there was.

4854. A temperature outside of 88° or 90° in the shade, do you remember that?—I mind it being particularly high in that summer.

4855. Had you any trouble at that time with your operatives complaining of discomfort?—No. I may say I think it would be at that time that I caused the night watchman to have doors and windows open all night to give it a fresh feeling in the morning. That was the year, I think, when I took that chemical for disinfecting and watered the floor early in the morning to cause it to be a little moister—that was Condy's fluid, and it was mixed with water. That was the year, I believe, when it was very hot.

4856. You had none of your operatives fainting, had you?—No.

4857. You found that the ordinary means of ventilation were sufficient?—Yes. We are what is called well ventilated. I do not mind of any fainting. I have known girls being unwell in the ordinary way, but fainting because of stifling air is a thing that I never knew in our place.

4858. What would be the effect, do you suppose, on the weaving if air had to be introduced from outside when there was a frost or a dry east wind?—It would be against us; and I may say even for the girls themselves I have more complaints from those in the immediate vicinity of ventilation than I have from those where it is extra warm. They would not like ventilation near them; they would rather have the ventilators further away.

4859. Why?—On account of the draught.

4860. You have no mechanical ventilation at all?—None. I have never worked in a place where it was; but I have seen them going; I have visited factories where they have had it.

4861. Have you many breakages of yarn in your class of goods, in the warp?—We have not a great deal. We have the usual quantity of breakages. Do you mean big breakages or ordinary?

4862. Ordinary odd ends coming down?—The usual quantity, sometimes more; it depends exactly on what it has to do.

4863. Still your material from what we could see is the very best you could buy?—Yes.

4864. The highest quality of yarn made from the best cotton?—Generally.

4865. And the dress or size just sufficient to weave?—Ordinary, just to weave; there is no other way of making it up.

4866. You still think if you were compelled to bring in air from outside when it was frosty or dry or there was an east wind, it would interfere with you?—Yes, it would interfere with our weaving.

4867. (Mr. Shackleton.) You say you have never found the necessity of that; that there has been no complaint of stuffiness?—No, there has been no complaint of stuffiness.

4868. In those times?—When it was hot.

4869. When you would have liked to have more fresh air it has not been oppressive?—It has not been oppressive. When they went outside for any purpose, if they were any time outside, they were glad to get in; it was as good inside as outside. The feeling I myself had when I was obliged to go out was that I was glad to get inside; it was quite refreshing compared with outside.

The witness withdrew.

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Miss A——C——, called and examined.

4870. (*Chairman.*) Are you a weaver?—Yes.

4871. How long have you been a weaver?—That was the first thing I learned; I have been at it ever since I was 14 like.

4872. How many years?—I am 27 now.

4873. Then you went to work as a weaver at 14?—Yes, and I learned and have been out ever since.

4874. You are about 27 now?—Yes.

4875. What sort of health have you enjoyed during that time?—Very good health.

4876. Where are you working now?— — Mill.

4877. How long have you worked in — Mill?—I have been in it very nearly all the days I was working, for I was just a very short time in another mill, just about two months, and I went to that.

4878. With the exception of a few months you have worked all the time in that mill?—Yes.

4879. And you told us that you have enjoyed good health?—Yes, very good.

4880. Do you ever feel the heat oppressive, or do you feel it very warm to work in?—No, it is not very warm; it is so near the brigg it is not very warm—just a nice heat for working.

4881. Do you ever complain of the cold?—Sometimes I have a cold, but I do not think it was the mill gave me it.

4882. Is the shed sometimes too cold?—Sometimes there will be a draught.

4883. Where does the draught come from?—I could not say.

4884. What ventilators have you in the shed?—I could not tell how many ventilators. I do not think there is a ventilator on the side where I am. It is at the back of where I am that the ventilators are.

4885. You do not know where the draught comes from?—No, I could not say.

4886. In the very hot weather do you feel sometimes the heat to oppress you a bit, make you feel tired?—No.

4887. In the winter, on the winter days when the gas is burning in the afternoons, does the air get a bit uncomfortable then?—No, I could not say that it does.

4888. You just feel it comfortable?—Yes.

4889. How many looms do you mind?—Two.

4890. Do you find any difference for weaving on the dry days and the wet days? Which is the better, a dry day or a wet day for weaving?—I think it is much the same.

4891. Do not the yarns break a bit more on the dry days?—It might be so, if it was very warm.

4892. Warm?—Yes, it might break more.

4893. (*Professor Lorrain Smith.*) On warm dry days in summer?—Sometimes you have better webs than others; I do not think it is the weather.

4894. You think it is the web more than the weather?—Yes.

4895. (*Chairman.*) You do not attach importance to the weather?—No.

4896. Is there anything that you think would make the shed more comfortable, or anything you would suggest that would make the place more comfortable?—No, I could not think of anything.

4897. It is just as you like it?—You know there are some parts of the mill which may be different from others. Where I am it is right enough.

4898. Do the other girls complain of anything at all?—No, I have never heard them make complaints.

4899. (*Mr. Hartley.*) Have you many ends or threads break in the web?—You know sometimes you have webs very good, and at other times they are bad enough. We could not tell how many ends break.

4900. But if you had frost?—The frost sometimes makes the webs go bad. Frost nips the yarn; it makes it break, d'y'see?

4901. Do you remember that hot summer two years ago?—You see, sometimes I do not be very constant, for I have an invalided mother, and I would be out very often keeping the house, but any other time I be in the mill.

4902. You do not remember the two years ago there was a very hot time?—I do not remember that.

4903. In August?—No.

4904. Just after the Fair—a little while after the Glasgow Fair—you do not remember it?—No, I do not remember it; it is no good my telling a lie, for indeed I do not remember.

4905. You have never felt like fainting with the heat?—No, I never did in all my life.

4906. You have not seen any of the other girls faint?—No, I did not; not in that mill anyway.

4907. (*Mr. Roberts.*) Have you seen it in any mill?—I never was in any other one. They might do it in other mills, but I have never seen them there.4908. (*Mr. Hartley.*) You know what a fan is?—Yes.

4909. Supposing a fan were put in the roof, bringing air in from outside, would you feel the draught, do you think?—Yes, you would feel a draught then, if there were fans.

4910. Do you think it would make the yarn worse?—Yes, it would.

The witness withdrew.

Miss A——K——, called and examined.

4911. (*Chairman.*) Are you a weaver?—Yes.

4912. How long have you been a weaver?—Between six and seven years.

4913. Where do you work?— —'s mill.

4914. Have you worked all the time in that mill?—Yes.

4915. Will you tell us if you have, generally speaking, enjoyed good health?—I have had an occasional day sick.

4916-17. Everybody has in all these years, but nothing, I take it, to do with your work; nothing that you would attribute to your work?—No, I do not think so.

4918. For instance, would you think that the illness was anything brought on by draught or great heat, or anything of that sort?—Oh, no.

4919. Or by breathing air that was not very good?—No, I do not think so. I never had any serious illness at all.

4920. Do you think that the condition of the shed is comfortable for the workers?—Yes.

4921. Have you any excessive heat to complain about at any time of the year?—No, only in the summer-time, when it is always very warm everywhere—in the very warm weather—but then they open up the ventilators.

4922. Are the ventilators kept open then?—Yes, they are opened up in the heat.

4923. In the winter days, when the gas is burning, does the air get very hot then?—No.

4924. On winter afternoons, for instance?—Yes, you can just work.

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4925. Does the air feel comfortable to breathe, or stuffy, in the winter afternoons?—I never feel any difference.

4926. (*Mr. Roberts.*) Always comfortable to you?—Yes.

4927. (*Chairman.*) Do you ever have any draughts to complain about?—No.

4928. Do you know what ventilators you have in your shed?—How many, you mean?

4929. What kind are they?—I cannot describe them. They open them up from the top. They are like windows.

4930. Do you get any draught from them?—No. You feel the place get cooler, but you do not feel the draught coming on to you. You feel the air getting clearer.

4931. You do not feel a draught playing on top of you?—No, you do not feel a draught on you.

4932. How many looms do you mind?—Three.

4933. That is pretty hard work to mind three looms?—Yes, it is hard, but I have been in very constant work. Very often I have a day off a week or a day and a half.

4934. You can take that and go back; there is no objection made to that?—No.

4935. In busy times would you be able to take a day off when you want to without objection?—If you are a good worker they would not take an objection.

4936. (*Mr. Roberts.*) Do you get someone else to take your looms when you go off for a day?—Yes.

4937. Or do your looms stand?—No.

4938. That goes on regularly?—That has gone on this last three or four years—not every week, but every week there is a good while—a morning off.

4939. (*Chairman.*) Do you find that the weaving is better on some days than others: I mean in frosty weather do you have any trouble about weaving?—Yes, we have more trouble then when it is frosty.

The witness withdrew.

Miss A— B—, called and examined.

4952. (*Chairman.*) Are you a weaver?—Yes.

4953. Where do you work?— —'s mill.

4954. How long have you worked there?—I was learnt there.

4955. How long ago: when did you first begin?—Fourteen years since.

4956. Have you worked there all this time?—Yes.

4957. Have you ever worked in any other mill?—A short time I was in —'s factory.

4958. About how long?—About three months.

4959. And you went back to your old firm?—Yes.

4960. Have you enjoyed good health during the time you have been a weaver?—I have not always had good health, but it was not owing to the factory.

4961. You have not suffered from anything that you would attribute to your work?—No.

4962. Do you consider the conditions of the shed in which you work to be comfortable?—Yes, they are pretty comfortable. I cannot say anything about that.

4963. You say pretty comfortable?—Yes.

4964. Do you ever suffer from too much heat or too much cold, or draught, or anything of that sort?—In the morning we are pretty cold, that is on the frosty mornings; there is not enough of steam on, but it has not been very cold this while.

4965. On very cold mornings you find it too cold, perhaps?—Yes.

4966. In the summer days do you find it very hot?—It is too close.

4967. Are the ventilators all opened in summer?—Yes.

4940. And with east winds have you any trouble then about weaving?—I know in frosty weather the yarn is very bad; it nips and breaks.

4941. In cold weather to a lesser extent?—In very cold weather they generally go, too.

4942. Does it make any difference in your wages?—Yes, when the work is going bad you get less money.

4943. You get less money at the end of the week in that kind of weather?—Sometimes, it depends on how your yarn is. Some weeks are well advanced when the wind comes.

4944. Supposing you had a cold east wind for a whole week, what difference would it make in your wages at the end of the week, do you think?—I could not tell you.

4945. I take it that it is not very serious, because if it were serious you would remember it?—It is nothing very serious; it is just the bother you have with the work; you have more work.

4946. As a matter of fact, I suppose, although you have harder work you get about the same money at the end of the week?—Well, yes, only there is much more work for the money with the yarn being bad.

4947. Is there anything that you could suggest that would make the shed more comfortable for the workers, or are you quite content with things as they are?—I think things are all right as far as I am concerned.

4948. (*Mr. Hartley.*) You have told us that in summer time the ventilators are open?—Yes.

4949. Does that mean that they are closed in winter, in cold weather?—Yes, they are closed in the winter time.

4950. Then there is no ventilation?—Yes, there is ventilation. I do not know if they are proper ventilators; they are big wide panes in the summer time that they open up wide with ropes. I do not know whether they are made for ventilators or not. When it is very, very warm they open them up.

4951. And those are not opened in winter time?—No, they are not open in winter.

4968. Are they open in winter?—Oh, no; they are kept closed in the winter.

4969. They do not open the ventilators in winter?—No.

4970. In winter in the afternoons it will be necessary to burn the gas?—Yes.

4971-2. What about the air in the shed then?—I do not feel it so much in the cold weather; it heats up the shed.

4973. Does it get stuffy?—No.

4974. You do not feel a sort of stuffy feeling, a bad smell about the air?—No.

4975. How many looms do you mind?—Two.

4976. Do you find that the weather makes any difference in the amount of work you have to do, or the east wind or dry winds?—The winds affect the yarn.

4977. How does the wind affect it?—It makes it break out a lot.

4978. That is, an east or a cold wind?—Yes.

4979. That means more work?—Yes, a lot more.

4980. Does it mean less money?—Yes, we are losing time.

4981. Does it make much difference in the wages?—Yes, it keeps us from getting our full amount.

4982. Is there anything that you think could make your shed more comfortable—anything you can suggest?—No.

4983. You are content with the conditions?—I am quite content with the shed.

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4984. (*Mr. Hartley.*) Do you remember the summer of 1906, a year last August?—Yes.

4985. Do you remember it being very hot?—Yes.

4986. Did you notice whether the weavers were suffering much from discomfort?—They suffered with the closeness of the mill with the heat.

4987. Did you see anybody fainting?—No.

4988. They were able to work without very much discomfort, were they?—Oh, yes—well, you know, they had to work when they were in; but it did not make them faint, but it was sore on them to work them.

4989. They were tired and jaded?—Yes, fatigued.

4990. (*Mr. Roberts.*) It was sore on anybody outside during that time?—Yes, it was, and that will give you an idea what it was inside.

4991. (*Chairman.*) It was worse inside, you think?—Yes.

4992. The reason we have asked you to come here is that we wanted to hear from the weavers themselves about things. As you know, we just took the numbers of the looms. We did not want to talk to the witnesses before they came, so that anyone could say

that they were told what to say or anything of that sort; so we just took the numbers and asked that you might come, because we wanted to hear your own opinions. There are no reporters here from the Press, and we are not publishing the names of the witnesses. Now, if there is anything you would like to tell this Committee that you think would add to the comfort of the weavers, just say so, let us know it?—There is nothing with regard to the heat or the cold, but there is as to the yarn.

4993. What about the yarn?—We do not get it good, and it is a lot of work to us, and we do not get making the pay we should.

4994. The yarn for the class of work you are on is supposed to be very good yarn, is it?—But it is anything but that; on one of my looms I can hardly get on with the yarn.

4995. (*Mr. Shackleton.*) How many looms have you?—Two.

4996. (*Chairman.*) Of course, as you have told us, the worse the yarn, or the worse the weather, the greater the amount of work for you?—Yes.

4997. (*Mr. Roberts.*) What sort of cloth do you weave?—I take check cloth and plain leno cloth.

The witness withdrew.

Mr. JOHN DAVIDSON, called and examined.

4998. (*Chairman.*) Are you manager or managing director?—Manager.

4999. Manager of?—Of Forrest, Frew & Co., Limited.

5000. They are weavers—how would you describe the firm?—Plain and fancy muslin manufacturers.

5001. How long have you managed those works?—Six years.

5002. Before that had you experience of weaving sheds?—I have had experience for 36 years.

5003. In Scotland all the time?—In Scotland all the time.

5004. Have you had any experience in mills that are artificially humidified?—No, none.

5005. All in dry sheds?—All in dry sheds.

5006. Can you tell us in what part of the country your experience has been chiefly gained?—All in the Glasgow district.

5007. During your long experience you have had no experience of artificially humidified sheds?—None whatever.

5008. We have seen the ventilation in your own particular works. Could you tell the Committee generally in general terms what methods of ventilation are adopted in the Scotch weaving sheds?—It is mostly from ventilators in the roof; mostly louvres; that is, two boards or three boards set at an angle with six inches between to allow air to pass in, but not a storm, rain, or snow or sleet.

5009. They are what are sometimes called louver gratings?—Yes, mostly that. A great many of the sheds, of course, have metal coverings on the top, little round things.

5010. That is the general system?—There are a great many of the sheds that have galvanised tops on about 18 or 20 inches high, and a swivel in the centre. They may be 18 inches or two feet in diameter, and on the centre there is pivotted a flap like a valve, and there is carried on that a little lever; if you want to shut it you draw it up.

5011. Those valves are inside the cylinder?—Those valves are inside the cylinder.

5012. Inside the cylinder there is a valve which is capable of being opened or closed, or partially opened or partially closed?—That is so.

5013. I suppose there is some covering on top of the cylinder to prevent the wet coming in?—It is round, conical on the top.

5014. Speaking generally, have you found those methods of ventilation satisfactory?—I must say I have never had any fault to find with the ventilation in Glasgow.

5015. Do you find the weavers as a rule to be a healthy class?—I do. There is very little sickness amongst them.

5016. We know there are certain times in hot summers when necessarily there is great heat on certain days?—In July we in Scotland experience possibly three weeks in the middle of July when it is very hot. Then, again, in the autumn at the end of August there are usually a few days very hot. On those days the boards are all kept open; everything is kept open; and there is usually a good current of air passing through the shed.

5017. Do you think on those days the workers suffer any serious bodily discomfort?—I do not. They do not undress at all. They just go about in the usual way.

5018. Coming now to the winter days, there must be some days in the winter, or in fact right through the winter when you have to light the gas pretty early, say at three or four o'clock in the afternoon?—In our factory every dark corner is installed with electric light.

5019. Have you the electric light right through?—Not right through; but in our plain weaving it is incandescent gas. But it is clear; there is nothing overhead. Sometimes we may be an hour or an hour and a half with plain looms burning gas. With harness weaving there is electric light.

5020. The rest of the shed is lighted with incandescent gas?—Yes.

5021. About what time do you light up in the winter?—There are some parts of the year when we are lit up all day.

5022. I would like to confine myself now to the winter, because in winter they would all be burning?—Yes.

5023. About what time would that be in the afternoon?—About midwinter we have to light at three o'clock.

5024. That gives you about three hours of gas light?—Yes.

5025. Do you find then that the air gets bad—you have taken no tests?—No tests, but we find the air is fairly good.

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5026. You find it is fairly good judging by your own senses?—By intelligent sense it is found to be comfortable.

5027. Is there any feeling of stuffiness or a sort of smell about the air?—No, I could not say that, because our gas is so high up, and the products from that do not come back. It is 8 feet or 9 feet up.

5028. The rarefied air would be hot and would rise?—Yes.

5029. Impure air would be above the breathing surface?—Yes, with the old-fashioned jets we had a double set, but now we have them much higher. Then we have all the dark places lit with the electric light, and the air is perfectly pure after a whole day.

5030. Will you give us your experience in regard to weather conditions for weaving? I think very often easterly winds are prevalent in this district?—They are in seasons. Possibly the worst time for that is February and March, and even this month. Then there are other years again when we have very little of that. About January and February are about the worst months for us.

5031. During cold and easterly winds how is your weaving affected?—It makes the yarns tender. We do not like east winds, but still we endeavour to keep the shed up to possible 66° or 67°, and we have done fairly well.

5032. That is the heat, 66° or 67°?—Yes.

5033. But the air would still be dry?—The air is dry, there is no doubt about that; but still we can always get on; there is nothing to keep us from getting on. There is no doubt we get on far better in a mucky week when it has been raining; then there is no doubt it is a good weaving week. But even with east winds we can get on very well.

5034. (*Mr. Hartley.*) On the point of discomfort. You say you have not noticed the workpeople suffer from the heat even in the hottest weather. You do not remember, perhaps, 1906, at the end of August. Do you remember that very hot time?—Yes, I do.

5035. Did the weavers seem unduly fatigued at that time?—No.

5036. There was no particular oppression?—No particular oppression.

5037. No necessity to knock off work?—Nothing of the sort. We have no steam on. All the ventilators are kept open with a current of air going through the place. There is no discomfort whatever.

5038. (*Chairman.*) Do you whitewash your glass or slates?—According to the arrangement of the shed the slates are in a position that the sun when it is brightest strikes them and not the glass, except the new shed, the small shed, and that we whitewash.

5039. (*Mr. Hartley.*) Do your windows face north?—Our windows face north.

5040. You have these ventilators that you have described. In winter time are they kept open or closed?—There is always a proportion of them open.

5041. Do you have those with the valves in?—We have none. All ours are those louvre ventilators.

5042. Do not you find it necessary to close those sometimes?—If the air is very heavy some of them might be closed, but still there is plenty of air coming in.

5043. Do not the weavers complain of draughts from them?—No, they do not. There might be some very cantankerous old persons who are never pleased. Here and there one might say, "There's a draught," but there is very little of that.

5044. Your rooms are lofty. Do you know the height from the floor to the ridge?—I really could not tell.

5045. Is it 21 or 22 feet?—It is every bit that; I believe it is more.

5046. The sheds, I notice, are much on one model here?—Yes.

5047. You have a large bay, what we call a wide bay, and you take the ridge of your roof to a great height up?—Yes.

5048. Higher than the Lancashire mills, much?—Yes.

5049. Of course, that may prevent the draught being felt so much, the ventilator being so far up?—It exhausts itself; it comes down more gradually; it spreads more gradually.

5050. Supposing you have had a strong east or north wind blowing, have you never had complaints from the operatives about draughts?—No, because our shed is protected by a high mill from the east wind. We are protected altogether from the east wind. The property all round about protects us from the east wind.

5051. There is another point. We notice that your floors are all covered with wood. It is a wooden floor that is a kind of false floor which is put on the top of asphalt?—Yes.

5052. What is the object of that?—It is more comfortable for the girls.

5053. More comfortable in what way?—It is drier for the girls' feet. We consider here that flag floors give them rheumatics. Standing or working about a whole day on flags gives them rheumatics.

5054. Still they all wear boots here?—They all wear boots here.

5055. Then you have not found it necessary to have a stone floor in order to get a little more humidity?—No, we never attempted anything of that sort. We never think about that.

5056. The quality of your material is exceptionally good?—It is the very best.

5057. Sea Island cotton?—The very best that can be got.

5058. Sea Island and Egyptian cotton?—That is so, the very best that can be got, and our preparation is second to none.

5059. (*Chairman.*) We shall be very glad to hear if there are any points in regard to ventilation or weaving sheds that you would like to bring to our notice, if you think there is anything calling for improvement or for consideration we shall be very glad to hear anything that you would say?—The only thing is this. If more air was demanded to come in I would suggest Tobin's tubes put into the wall with a grating. Those wooden tubes would go up the wall and carry the air above the heads of the girls. If anything more were demanded that is what I would like. I have some of them in our warehouse. I think that the best plan, and better than mechanical fans.

5060. Supposing you were to put mechanical fans into your shed—plenum fans, that is bringing air in—what effect would it have on your weaving?—I do not like them at all. I was twenty years managing partner with another gentleman, and I ran two mills. One of our sheds we found a little bit stuffy. I put two Blackman fans in, and I did not like them at all.

5061. What was your objection?—Somehow or another the girls did not like the way the air came in.

5062. Did they complain of draught?—They complained of draught.

5063. Did it affect your warps?—It affected the warps too.

5064. In which way, beneficially?—Not beneficially; we do not like draughts on the warp at all.

5065. They were Blackman fans, bringing air in?—No, expelling air, exhausting it.

5066. (*Mr. Hartley.*) On that point did you notice that those fans raised the dust and the fluff—lifted it from about the looms?—We had to clean those fans very often. There were large boxes.

5067. I do not mean that. Did you notice that the shed looked very hazy, as if there were dust?—That is so. I noticed that particularly, and over and above, where it exhausted itself out, we had to clean the blades and all about the fan often; they were stuck up with black greasy dust. That is an experience of my earlier days.

5068. (*Mr. Roberts.*) And it affected your weaving?

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—We did not like them at all. The girls did not like them at all; and that is the reason why, if there should be any demand for more air to come in, I would rather have those Tobin tubes.

5069. (*Chairman.*) I suppose it would be possible,

in the event of using something like a Tobin tube, to have a coil in it to warm the air, if necessary. You see, if the air came in absolutely cold it would be quite uncomfortable?—That could be done quite easily—much more easily done than with a fan.

The witness withdrew.

Miss B—— S——, called and examined.

5070. (*Chairman.*) You are employed at the works of Messrs. ———?—Yes.

5071. Are you a weaver?—Yes.

5072. Have you spent your whole time as a weaver in those works?—Yes, I have never been in any other place.

5073. How long have you worked in those works?—Fifteen years.

5074. And during that time have you enjoyed good health?—Yes.

5075. You have never been in the doctor's hands?—I have been off for a week with a cold.

5076. Do you attribute that cold to ordinary circumstances?—Yes.

5077. Nothing to do with your work?—That is so.

5078. Do you find the shed in which you work comfortable, as a rule?—Yes.

5079. It is ventilated I think, is not it?—Pretty well ventilated.

5080. In the excessive heat of summer, do you find any oppression or any difficulty in working in the shed?—There are mechanical fans in summer time, which makes a great deal of difference.

5081. Those are put on in the summer, and make a good deal of difference?—Yes.

5082. And on the winter days are the ventilators kept open as a rule?—They are kept closed in the winter time; they are opened when they are needed.

5083. But, as a rule, they are kept closed in the winter time?—Yes, it just depends on the weather. The weavers can open and shut them to suit themselves.

5084. I suppose in winter you light up about three or four o'clock?—Something before that; whenever it is needed; whenever it gets dark.

5085. Does the air get oppressive in the weaving shed then?—I have never felt that.

5086. You have never felt it uncomfortable?—You could not expect anything else; it is a little close sometimes, but nothing to talk about.

5087. You say that you could not expect anything else, but it is nothing to talk about. Of course, we know that perhaps under certain conditions you could expect nothing else, but the point is, is it uncomfortable?—No.

5088. You do not feel it uncomfortable?—No.

5089. I suppose the weaving is better on rather warm and moist days than on dry days?—Frosty weather affects the weaving.

5090. And do cold east winds affect it much?—It is in frosty weather we feel the difference.

5091. Is it enough to make any difference in your wages?—No, it does not make much difference in mine.

5092. I should explain to you that the reason we ask you to come here, and that we have asked other weavers to come here is that this Committee is taking evidence over the country, and we wish to have the opinions of the weavers themselves; and you may have noticed that we did not take your name or ask you any questions at the works; we simply took the numbers of the looms, because we do not want it to be said that witnesses had been picked out who had been spoken to. So we just took the numbers of the looms, so as to get the independent opinions of the weavers themselves. If there is anything you would like to say to this Committee that you think would improve the sanitary condition of the shed or the comfort of the weavers, we would like to hear it from you?—I have nothing to say, but that it is kept in good sanitary order.

5093. (*Mr. Shackleton.*) Do you work in the ——— Mill?—The ——— Mill.

5094. (*Mr. Hartley.*) In the ——— Mill?—Yes.

5095. That is in ——— Street?—No, it is in ——— Street.

5096. (*Chairman.*) The ——— Mill, ——— Street?—The ——— Mill is in ——— Street.

5097. How many looms do you work?—Two.

5098. You have not felt any discomfort from heat, you say?—No.

5099. Not even in the dry hot weather two years ago?—In the hot weather you feel the heat great enough, but the fans were the same at that time. The fans make a great difference; they have been up two years.

5100. The ventilators are closed, I think you said, in winter time?—The weavers can open and shut them to suit themselves.

5101. (*Mr. Shackleton.*) Those are windows?—Yes, there is a rope attached.

5102. It is not the Boyle ventilators you refer to?—It is the windows only.

5103. (*Mr. Hartley.*) Those windows are not opened in winter time?—I have seen them just opened and shut. If the weavers feel a draught they can shut them themselves, or they can open them.

5104. Are those doors and windows open in summer time during the meal hour?—Yes.

5105. That is in the breakfast and dinner time?—Yes, they are kept open.

5106. Do you find that to improve the atmosphere?—It helps a lot. In summer time they are open, but in the winter time they are kept shut.

5107. They are open while you are working as well as in the day during the hot weather?—Yes.

5108. You do not feel a draught then, do you?—No.

5109. (*Chairman.*) You have no suggestion to make to the Committee?—No.

The witness withdrew.

Miss E—— S——, called and examined.

5110. (*Chairman.*) You are a weaver?—Yes.

5111. And you work for Messrs. ———?—Yes.

5112. At their ——— factory?—Yes.

5113. How long have you worked there?—Nine years this September.

5114. Have you worked anywhere else as a weaver?—Yes, I worked at the ——— Mill.

5115. (*Professor Lorrain Smith.*) Whose is that?—It is ———'s.

5116. (*Chairman.*) How long did you work there?—Four years there.

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5117. What sort of health have you enjoyed there since you have been occupied as a weaver?—I have enjoyed very good health. I have never been off my work but once.

5118. For how long?—A fortnight.

5119. Were you in the doctor's hands?—I just had the doctor once.

5120. Was your complaint due to cold or chill?—Yes, I caught a chill.

5121. Was that in your present works?—Yes.

5122. To what do you attribute the chill—can you account for how you got it in any way?—I was out late one night and heated myself, and I caught a chill. That is the only way I can account for it.

5123. You do not think you got it in the works?—No.

5124. Do you find that the weaving shed is a comfortable place to work in?—Yes, it is a very comfortable place.

5125. How many looms do you mind?—Two.

5126. Do you feel any oppression at the end of the day's work—do you feel very tired, or do you feel as if you were pretty comfortable at the end of the day's work?—I go out at night; if I was tired I would not be able to go out.

5127. You feel well enough to go for a walk in the evening or go out and see your friends in the evening?—Yes.

5128. Is that the same all the year round? In the very hot summer days do you feel too exhausted to do that sort of thing in the evening?—I have always felt I was able to do it at night after my day's work.

5129. In winter when the gas is burning do you feel any oppression, or feel it uncomfortable?—It is quite comfortable to work in.

5130. Both in the summer days and in the winter days when the gas is burning?—Yes.

5131. Have you ever felt any inconvenience from draughts in the shed?—No. I think that the only time that the fans are on is when we need it.

5132. That is in the summer?—Yes, when it is very hot.

5133. In the winter are the ventilators open at all?—No; we can open the ventilators of our own accord if we need them open.

5134. Do you sometimes open them in the winter?—I have not. Only if a girl feels the heat she opens it herself.

5135. As I have explained to the other witnesses, we have asked you to come here to-day because we want the opinions of the weavers themselves. When asking that the ladies should come, we simply just took the numbers of the looms; we did not want to talk to you beforehand; we wanted you just to come and give your own opinions, and that is why you are here. We want you to say if there is anything you think requires improvement, or if there is any grievance in regard to the sanitary condition of the workers. Anything you like to tell us, tell us. If you have nothing to complain about, say so?—If I had anything to complain about I really should be glad to tell you, but —'s mill is really in good condition all through, and anything we have wanted they have always been very pleased to get done immediately.

(Chairman.) That seems very satisfactory, I think.

5136. (Professor Lorrain Smith.) At neither of the mills you have worked in have they had steam?—They have steam.

5137. But I mean blowing in steam?—We have no blowing in of steam.

5138. (Chairman.) In this district it is not done, but I daresay you have heard that in some districts they send steam into the shed to make the atmosphere moister?—Yes.

5139. You have no experience of that, you know nothing about it?—No.

5140. (Mr. Hartley.) Have you noticed in frosty weather, when the air is nipping, whether it has any effect upon the yarn, whether the warp breaks more, whether the ends break more?—On a frosty morning it does not tend to make the yarn go well. We have good yarn in —'s. I have heard complaint about the yarn going bad on a frosty morning in other places.

5141. But you have not felt that?—No. I must say my work goes splendid if you watch the work; but, of course, if you are careless you cannot get on.

5142. (Mr. Shackleton.) You can say then that you are perfectly satisfied, that you have no complaints to make, and you have fairly good health yourself?—Yes.

5143. You do not desire any change?—I should have no objection to anything better.

5144. But you cannot suggest anything?—No.

5145. (Chairman.) You would not object to double wages, for instance?—No.

5146. (Mr. Hartley.) The material you use is very good material?—The yarn is good.

The witness withdrew.

Miss J—— H——, called and examined.

5147. (Chairman.) Are you a weaver?—Yes.

5148. You work at Messrs. ———?—Yes.

5149. At their ——— Factory?—Yes.

5150. How long have you worked there?—I have been ten months only there.

5151. Did you work in a weaving shed before anywhere else?—Yes, at —'s; I was there for nine years.

5152. For nine years?—Yes, over nine years.

5153. What sort of health have you enjoyed during the time you have been employed as a weaver?—I have had very good health so far; little troubles, but not anything serious since I have gone to weaving.

5154. It is too much to hope that one should go nine or ten years without some minor troubles. Are they troubles that you would attribute to your work, that you would say were brought on by your work?—Oh, no.

5155. Take the shed that you are working in now, do you think it is a comfortable place to work in?—Yes, I feel very comfortable in it, more so than the one I had left.

5156. How many looms do you mind?—Two.

5157. Have you felt at any time during the hot summer months any feeling of oppression or tired feeling at the end of your day's work?—Not since I have worked in there. It was in June when I went in, and I have been very well pleased. I thought it was more comfortable than —'s. I felt the heat more there than at —'s.

5158. In the works do you feel any feeling of oppression at the end of the day's work?—Yes, I did sometimes, very strongly too.

5159. Was that due to great heat?—Yes.

5160. Was there any ventilation there?—There was a ventilator a little up past me, but it was an open window, and the minder got cold on one side where I was standing, on one side of my face.

5161. That was a draught?—That was so.

5162. You got the ventilation and the draught at the same time?—Yes.

5163. I suppose it was shut after?—Yes, they had to close it.

5164. What time of the year was that, do you remember what month?—I could not exactly say about the month, but just the middle of the summer.

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Miss J— H—.

5165. About —'s place in winter when the gas was burning, of course, you would have to light up about three or four o'clock?—Yes.

5166. Did the room get very hot or oppressive?—No, you could work in it and feel quite comfortable.

5167. That was in the winter?—Yes.

5168. And were the ventilators closed then?—Yes.

5169. Did the air get as far as you could tell stuffy and feel uncomfortable when the gas was burning like that?—No, I could not say anything about that.

5170. You did not feel it so?—No.

5171. Where you work now you have felt no inconvenience at all?—No, I am very well satisfied with where I am.

5172. You have worked as a weaver for a good many years: do you think the weavers as a class are healthy girls?—So far as any I have come in contact with I have never heard them say to the contrary.

5173. Do you think they would compare favourably with young ladies in shops, shop assistants?—I could not say anything as to that.

5174. You do not know?—I could not say.

5175. As far as you know the weavers are a healthy class?—Yes, so far as I know.

5176. We have asked you to come here because we want to hear the opinions of the weavers themselves, and as you know we did not speak to you before you came here; we just took the numbers of the looms. We thought it better to take a few numbers so as to get the weavers indiscriminately so that it should not be said that they were selected. We have asked you to come here to express your views. Is there anything that strikes you would add to the comfort or health of the workers in this weaving shed?—I could not say anything in —'s. I am very well pleased with that so far.

5177. In the other place where you worked so many years, is there anything?—The only thing was the oppressive heat in the summer time; it sometimes was very strong.

5178. Do you find in the winter, for instance, where there is frost, or even where there is no frost, but where there is a cold east wind, as you have sometimes here in the early spring, that weaving is difficult; I mean that the threads break more?—Yes. It depends a great deal on what sort of yarn you have to work.

The witness withdrew.

Miss J— Y —, called and examined.

5192. (Chairman.) You are a weaver?—Yes.

5193. And employed in Messrs. —'s weaving factory?—Yes.

5194. How long have you worked there?—About eight and a half years; six years in —, and about three years in another mill.

5195. Six years in —?—Yes.

5196. And three years where?—In —.

5197. Belonging to the same Company?—Yes.

5198. That is nine years you have worked as a weaver?—Yes.

5199. What sort of health have you had?—Very good.

5200. Your health has not suffered in consequence of your occupation?—No.

5201. At the end of the day's work do you feel very exhausted, or do you feel in the summer evenings as though you would like to go and take a walk and see your friends, or do you feel too tired?—No, not too tired.

5202. At the end of the day's work you feel that you are not very exhausted?—No.

5203. In the very hot weather in summer do you feel more exhausted than in the winter?—Yes, a little.

5179. With the yarn you are working now you have no difficulty; it is very good yarn?—It is very good yarn.

5180. And the difference then between the cold dry days and ordinary days is not very appreciable?—No, it does not make any difference where I am at present.

5181. (Professor Lorrain Smith.) It makes a big difference if the yarn is not so good?—Yes, it makes a big difference; you cannot get your work done; you get more tired; you are more tired on your feet with running round.

5182. You were nine months here?—Ten months.

5183. The last summer you had in —'s was a very hot one, was not it?—I could not just call to mind, but at different times I felt it in the summer-time.

5184. The summer of 1906?—One summer it was really dreadful to work in.

5185. (Mr. Hartley.) It was very hot in other parts of the country in 1906—that is, the summer before last; can you remember that summer?—I cannot say that I remember that summer, but one summer I think you would remember if you had been in that place.

5186. What did you feel you required—was it more ventilation?—Yes, I felt if there had been more air we should not have felt it so much.

5187. It was not so much the heat as the closeness?—It was very close.

5188. What ventilation had they there at this place—had not they opening windows?—There is the ventilator up every second pass; there was not one up my pass. There was a steam pipe up the pass I worked in. There was a ventilator in the next pass, but there was a good distance between the ventilators.

5189. (Chairman.) I suppose they were open in the summer?—Yes.

5190. (Mr. Hartley.) There were not sufficient of them, you say?—I thought they could have been perhaps nearer to one another. There was one to every other pass. I thought there could be more. Sometimes, when they were open, it made the yarn to go very bad. I have known them to be opened and other weavers to go and shut them.

5191. (Chairman.) There is nothing else you would like to suggest to the Committee?—No.

5204. Have you in the very hot summer weather felt towards the end of the day's work any feeling of great oppression, or have you felt very tired?—No.

5205. Nothing of that sort?—No.

5206. In the winter months, when the gas is burning in the room I suppose it is more or less close, is not it?—Well, no.

5207. You feel nothing unpleasant about it?—No.

5208. Are the ventilators in the — factory kept open in the winter?—No.

5209. Never?—You can just open and shut them as you wish.

5210. I suppose, as a rule, they would be closed?—Yes.

5211. Perhaps sometimes they would be opened?—Yes.

5212. In summer are the ventilators kept open?—No, you can just open or close them as you wish yourself.

5213. I suppose that we may take it that in summer time generally they would be open?—Yes.

5214. How many looms do you mind?—Two.

5215. We have asked you to come here because we wanted to hear the opinions of the weavers them-

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selves, and I daresay you noticed we did not ask you your name, but just took the number of the loom. We always do that, because we do not want anybody to say that this person or that person was chosen. We take them by chance so as to get the independent opinion of the weavers. If there is anything you would like to tell us or there is any suggestion you would like to make that would add to the comfort of the weavers, make the place more healthy, we should be very glad to hear it?—I feel quite satisfied.

5216. (*Mr. Hartley.*) Were you working at — weaving factory two years ago?—Yes.

5217. Can you recall that spell of very hot weather

in the summer a little after the Fair—do you remember that?—Yes.

5218. Did you feel any great discomfort then?—No.

5219. You did not?—No.

5220. You did not feel oppressed?—No.

5221. Or languid?—No.

5222. You did not see any operative that looked like fainting or being overpowered with the heat?—No.

5223. There are two fans, I think, are not there?—Yes.

5224. And you have also some ventilators that you can open or close with strings?—Yes.

The witness withdrew.

ELEVENTH DAY,

Friday, 24th April, 1908.

At Bradford.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.

Mr. WILKINSON HARTLEY.

Professor J. LORRAIN SMITH.

Mr. F. THOMAS.

Mr. D. R. WILSON (*Secretary*).

Mr. WILLIAM HENRY SEAL, called and examined.

5225. (*Chairman.*) You are one of His Majesty's inspectors of factories?—Yes.

5226. And have been for how long?—17 years.

5227. How long have you had charge of the Bradford district?—Nearly 8½ years.

5228. Can you give us the number of cotton cloth factories in Bradford itself and in the whole of your district?—There are none in Bradford proper, but there are six cotton cloth weaving sheds in my district using artificial humidity, about 100 dry cotton weaving sheds, and an increasing number using a mixture of cotton and worsted.

5229. Where are those situated—in what neighbourhood?—Silsden, Steeton, Cowling, and Skipton. As you get further away from Bradford towards Lancashire you get a tendency to use both cotton and worsted.

5230. But in Bradford itself?—In Bradford itself you get mainly worsted—or exclusively.

5231. But how many cotton cloth weaving sheds are there in Bradford itself?—None.

5232. No cotton cloth weaving sheds in Bradford itself? Do you mean in Bradford city or Bradford district?—Not till you get to Skipton area.

5233. Neither humid nor non-humid?—Yes, neither humid nor non-humid.

5234. You have a certain number of worsted mills working under the French process?—Yes.

5235. And in the French process artificial humidity is introduced?—Yes.

5236. The French process is known as the dry process?—Yes, it is an alternative expression—"French" or "dry."

5237. Can you tell us why it is called the dry process?—Yes, the wool lacks moisture, it is not treated with olive oil at all, it is in an absolutely dry condition, and humidity becomes an absolute necessity for its proper spinning.

5238. That is what I was leading up to. There is, I think, an official table of humidity published in the Factory Act for the French process?—Yes, as distinct from the one applicable to cotton weaving sheds and textile mills generally.

5239. Throughout that table there is allowed a difference between the readings of the wet and dry bulbs of two degrees?—That is so.

5240. Can you tell us why that two degrees limit was fixed?—I think it was held that they required a larger percentage of humidity in the atmosphere owing to the material being spun—the dry material.

5241. Have you from time to time seen the returns of humidity from these mills?—I have.

5242. And have you personally examined the thermometers when going through?—I have.

5243. As a result of your inquiries, have you found that the two degrees limit is approached as a rule?—No, it is never attained; very rarely do they approach to the maximum.

5244. Speaking from memory, what would you say is approximately the difference in the readings between the thermometers?—I have these figures here if you care for me to read them.

5245. If you please?—These following particulars, I may say, are taken from the records when the air samples were taken for the purpose of being analysed by the Home Office. In the French or dry process the highest record of temperature was 77.

5246. Was that the wet or dry bulb?—That is the temperature of the dry bulb.

5247. The highest record of temperature with the dry bulb was 77?—The lowest 68, the average 73·1.

5248. Over what period does this extend?—This was the last record that was taken when the last analysis of air was suggested. These particulars are taken from the records which were sent to the Home Office.

5249. The record extending over how long?—It was a record that was simply the indication of the con-

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dition of things existing at the time when the air sample was taken.

5250. This was on one day?—This was on one day.

5251. (*Professor Lorrain Smith.*) It is from a number of cases?—In the French process all the inspectors require is to have an air sample taken, and to keep that as a record. In these cotton weaving sheds we are bound to take them every twelve months.

5252. But this is an average of a number of results?—It is an average of all the air samples taken from the French or dry process. The highest recorded temperature in the district, at the moment when the air samples were being taken—the highest recorded reading in any one factory—was 77.

5253. (*Chairman.*) That is the highest recorded reading?—Yes, the lowest was 68—this is of the dry bulb—and the average was 73.1. The highest wet bulb reading was 72, the lowest 62, and the average 68. The results of the analyses of the air samples show that the highest percentage of CO₂ was 6.6, the lowest was 3.9, and the average 5.4.

5254. Those refer to how many sheds?—There are nine rooms in my district using humidity in the French or dry process.

5255. (*Mr. Thomas.*) Were you asked to take the CO₂ in the outside air?—No, I was not asked to take that. Do you care for me to supplement those figures by the figures relating to the cotton cloth factories and other humid factories, as distinct from the French or dry process?

5256. (*Chairman.*) Over what period does it extend? Does it give anything relating to the time of the year, or dates?—I can give those, but I had not them here. I simply collected these figures on my own initiative.

5257. What does this refer to now?—These are the temperatures of the wet bulb readings and the ultimate result of the CO₂ of all the records in the humid cotton cloth factories since 1906. I have taken the highest, the lowest, and the average, of the records when the air samples were taken.

5258. (*Mr. Cross.*) That is irrespective of humidity at all?—Yes, I have taken December, 1906. The whole of the readings have been totalled—those referring to the humid cotton cloth factories in my district, of which there are six—and the highest recorded temperature on those occasions was 68°; the lowest 58.8°.

5259. (*Chairman.*) Dry bulb?—That is the dry bulb. And the average was 61.5°. With the wet bulb the highest reading was 64°, the lowest 55.5°, and the average 56.5°.

5260. In what year was that?—That is the whole of the records that have been taken since 1906. We are bound to take them every year in those, but these others I have just referred to are just the one record which we are required to take for reference.

5261. (*Mr. Thomas.*) Have we to take it that the highest wet bulb refers to the same place as the highest dry bulb?—No, not necessarily. It is most likely that those figures 64° and 68° refer to the same, but that could only be verified by reference to the records which I have.

5262. (*Chairman.*) You can tell us from your own experience and your own study of the records what approximately is the average difference between the wet and dry bulb thermometers?—You are speaking of the French or dry process now, are you?

5263. Yes?—The difference is 8°.

5264. The average is about 8°?—Yes.

5265. Then it would appear from that that the amount of humidity allowed by law is not a necessity, that as a matter of fact it is much more generous than is necessary?—Yes. I should like to say, if you will allow me, with regard to those figures, that I had not been asked to prepare them, and to have got them out thoroughly I should have had to have searched all the records that have been sent in from all these mills. I had not time to do that, and I did not think it was required, as my district is not so important as some others on this subject, but I thought it might interest you to hear these figures worked out from the records upon which the air samples were taken. So these figures of mine here are based solely upon those

occasions when I, or my junior, have visited to take air samples. These are the reliable samples which deal with those occasions.

5266. Of course, you probably will supplement this information by the dates?—Yes.

5267. It will make it much more valuable if we have the dates?—There are still the other humid factories to deal with. The highest recorded temperature on those occasions was 80°, the lowest 63°, and the average 72°. The highest wet bulb reading was 72.5°, the lowest 58.5°, and the average 65°. The results of CO₂ at these other factories were: the highest 10.2, the lowest 3.2, and the average 5. I thought possibly it would interest the Committee to know the conditions of the air at the mills which you have visited since you have been in the district. Taking —, where you visited yesterday, the CO₂ results were 3.5 in one room, 5.6, 4.6, 5.1, 5.7, and 6.7. In —, the — Mills, which you afterwards visited, the results were 5.6 in one room, 3.5 in another. At —, which you visited, at —, the last result of theirs is 6.6. In — Mills the readings were 6.9, 6.5, 6.6, and 6.5, and in —, which you visited last, the readings were 5.5, 4.2, 3.9, 5.3, 4.9, 4.2, 4.6, 4.3, 4.4, 4.4, 5.8, and 3.9.

5268. (*Mr. Cross.*) When were those taken?—These were taken at the latter end of 1906.

5269. Not in relation to our present visit at all?—No, it is the one result which I have of that mill. Of course we are not bound to take those yearly, like cotton-weaving sheds.

5270. (*Chairman.*) In the epitome you refer to certain advantages to workers in cotton cloth weaving sheds, in which artificial humidity is introduced. I should like to ask you if these conclusions which you have arrived at are based upon the knowledge you have gained in this district, or have you any extensive knowledge of the cotton trade elsewhere?—No, I had no experience prior to taking charge of this district.

5271. In regard to textiles?—My results are entirely based upon my experience and observations whilst in charge of this district.

5272. The remarks which you are about to make would apply then to this district?—Yes, entirely. All my experience there.

5273. Now you refer to Section 94. Would you mind turning to Section 94?—I refer to air samples there. Would you care to have any opinion upon that as to my experience of the results of the analyses there?

5274. What particular part of Section 94 do you wish to refer to?—The whole of Section 94 are regulations applying to cotton cloth factories.

5275. The first paragraph refers to the question of the purity of the water used for the purpose of humidifying. Do you wish to say anything with regard to that?—No, I have simply taken them as a whole, and would describe them as very beneficial regulations, and the workers in cotton cloth factories get the distinct advantage of the benefits arising therefrom.

5276. How would you describe those benefits?—Broadly, as extremely good, useful and beneficial ones.

5277. Perhaps we might take it in detail. First the question of pure water for the purpose of humidifying. You think that a salutary regulation?—I do.

5278. And has it been, as a rule, observed in your district?—Yes, it has.

5279. From what source is the water generally obtained?—I have verified that they have always been fresh, pure sources.

5280. And have you had no question of any complaints from the operatives or their representatives, at any time with regard to the water?—Never.

5281. Then the question of covering the pipes for the introduction of steam. How are those pipes covered, as a rule, in your district?—I think they are covered with a kind of asbestos covering. They are all efficiently covered, and I have had no complaints of any injury to health or bad conditions of air arising therefrom.

5282. As a rule, have you found that the nine-standard with regard to CO₂ is observed?—I have known one or two extraordinary exceptions.

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5283. But, as a rule, you have found it observed?—
I have.

5284. Is it the custom to limewash the roofs of the sheds in this district?—Yes.

5285. Where humidity is used is it compulsory?—
Yes.

5286. Is the custom extended to other places where it is not compulsory?—No, not generally.

5287. You mention as an advantage of artificial humidity, that there is better-woven material, resulting in increase of wages?—Yes, better-woven material, resulting in the national reputation for excellence of goods, from which follows increasing trade and better employment.

5288. There are, as you know, a great many weaving sheds where no artificial humidity is introduced?—Yes.

5289. Do you know that in those sheds excellent cloth is produced?—Yes, I am told so.

5290. Have you considered, in making this statement, that much may depend on the kind of warp and the kind of weft that is used, and that that varies in different districts?—My experience is, perhaps, not sufficiently large to speak with any great value on this special point which you raise, but I have frequently raised the point as to why so many cotton sheds are not provided with artificial humidity, and the reply I have received is that employers really wanted it, but the owners of sheds will not, unless obliged, go to the expense of providing the necessary plant; and one occupier who has two sheds, in one of which artificial humidity is provided, and in one of which it is not, states that he loses 4d. per week per loom in the non-humid factory, owing to the extra time the loom stands to enable the weavers to piece broken ends.

5291. Who says that?—That statement has been made to me by the occupier of two mills, one of which is a humid factory and one a non-humid factory. I may say this one which I am quoting is a worsted mill.

5292. That is an occupier's statement?—Yes.

5293. Have you at any time heard any expression from operatives in regard to their desire, or otherwise, for humidity?—No, I have never heard any appreciation or condemnation of it as a system from the operatives.

5294. Before putting this question to you I was careful to ask you if your experience was gained in this particular district, because we have been taking evidence all over the country, a good deal of which would not agree with the view you have formed here. So I was very careful to ask if it refers to this particular district only?—Yes.

5295. Then if it results in higher wages, that probably would be where inferior yarn was used?—Possibly.

5296. Then you consider that the artificial humidity does a great deal towards settling the dust?—Yes. On that point I hoped to call Dr. Roberts, the late certifying surgeon of the Barnoldswick District to give evidence thereon, but he died last week. I know, however, that his opinion was, from a hygienic point of view, in favour of the use of artificial humidity.

5297. You refer to the workers, and suggest that they benefit by the use of artificial humidity, assuming that they are suffering from pulmonary trouble?—Yes.

5298. Do you mean that the benefit is only for those people, or that it is a general benefit to the workers?—I should say that it is a benefit specially to those who are troubled with pulmonary complaints, or weak chests. This is my note thereon if you will allow me to quote it. There is the further minor advantage that people suffering from weak chests or any pulmonary troubles can work much better in humid rooms, and I am told of a humid mill in my district where there is quite a demand for employment, when the mill is running at night, by people who cannot, or will not, work therein at any other time.

5299. Have you considered that those people would be very much in the minority?—Quite so. I just refer

to it as a minor advantage. It would be very limited, of course, in scope.

5300. Have you considered what the effect of artificial humidity would be upon the majority of the workers?—Yes, I go on later to speak as to the disadvantages which might arise therefrom.

5301. What do you consider to be the disadvantages to the workers or using artificial humidity?—Before answering that may I just refer to one other advantage which, it is alleged, the weavers get, that is that they get fewer broken ends, and consequently a higher weekly wage. That some of the workers realise the advantage of keeping the warp damp is shown by a crude method sometimes resorted to by weavers in the Earby district, who hang a damp cloth over the beam at the back of the loom.

5302. It is done all over the country?—I know it is done in my district.

5303. At certain times under certain conditions?—Then you asked as to the disadvantages. First, I think the risk to health through coming suddenly out of a hot temperature into the open air whilst wearing damp clothing is a real grievance, to remedy which I consider Regulation 5 of the Cotton Cloth Regulations, requiring a sufficient and suitable cloak-room to be provided for the use of all persons employed in a cotton cloth factory, and ventilated and kept at a suitable temperature, should be made to apply to all such factories whether erected before February 2nd, 1898, or not. That is Regulation 5, which only applies to factories constructed since then.

5304. Have you considered the question of space. I mean to say have you realised that there may be a great many places where they cannot get the room?—I have mentally reviewed the mills in my district to which this would apply if it was enforced, and I do not think there is a single one where the difficulty could not be overcome. The second disadvantage is the offensive taste and smell often so prevalent in such sheds, due to the evaporation of the size on the warps. This, although objectionable and somewhat depressing, is not perhaps distinctly harmful, and possibly the objection arises more from sentiment prompted by supposed injury to health therefrom.

5305. You speak of damp clothing. How do you think the clothing would become damp in these places?—They invariably hang their clothing in the shed where the artificial humidity is being introduced, there being no sort of cloakroom provided; and it cannot be enforced.

5306. Of course, theoretically, unless the dew point is reached, there should be no deposit of moisture. The question there comes in as to where the clothing is hung—whether it is hung on walls or iron pillars, or anything of that sort, where there is condensation going on?—Yes.

5307. But have you in mind also the effect of perspiration on the clothing?—No. I have not that so much in mind as the result of artificial humidity.

5308. I take it you have had no opportunity of studying scientifically, or by experiment, the effect on the human system of working at high temperatures in a moist atmosphere?—I have not. I have no evidence on that point. In Bradford, I may say, in the weaving sheds here, they change their clothing far more than they do in the cotton districts. The weavers frequently change their skirts and ordinary clothing when they go to their meals.

5309. The next point we have already dealt with—that is in respect of artificial humidity in the French or dry spinning process. That is allowed a higher percentage of artificial humidity. Worsteds drawing we have not touched on?—I have one or two figures here that I thought might be interesting, from the Chamber of Commerce. What I have said upon this point, if you will allow me to read it, is this. All wool contains a large percentage of moisture, and the spinning of it is usually carried on with a small amount of olive oil. All worsteds was so spun until Sir William Holland introduced the Continental way, namely, the French or dry process similar to cotton spinning. The introduction of artificial humidity became a necessity, but in a different degree, as will be shown by the standards of moisture fixed by the Chambers of Com-

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merce in Bradford and Manchester. For cotton 9 per cent., 10 per cent., and 11 per cent., according to the material. Wool in the top, to be spun in the French way—that is, of course, more applicable to my own district—18½ per cent. Wool in the top, to be spun in the ordinary way, 19 per cent. The only method of French or dry spinning is by the self-acting mule, and a small difference in the amount of humidity present in the atmosphere is sufficient to cause the snapping of hundreds of ends. If too much is present the yarn sags when the mule is out and breaks, or causes bad spinning. I am told that there is another point. Ventilation also is difficult, and must be delicately applied, as even an open door or a draught from a window is sufficient to cause the yarn to snap in the vicinity, so much so that in America, I am told, double windows are provided to prevent draughts. The reason why more humidity is required in the French process is due to the electrical conditions set up in the spinning of wool in dry weather, especially when the wool has no oil in it. It is obvious that dry wool being spun in dry weather at a high rate of speed will cause the ends or strands of the wool to project in a bristling manner, owing to the action of repulsion set up, and it is to overcome this that the use of artificial humidity becomes a necessity. Doubtless this Committee will have seen photographs of strands of material both before and after humidity of a certain percentage. (*The witness indicated certain drawings.*) When you come to the ordinary worsted spinning and drawing—the latter is a thinning or thickening of the required thread—there is no need for a high percentage of artificial humidity, owing to the natural moist flexibility of the wool combined with its oiled condition, and it is quite sufficient if the outside moisture is attained.

5310. I dare say some of the Committee have some points on which they would like to ask you?—May I just read the last portion of this. I thought perhaps you would like to know the reasons why there are few, if any, complaints by operatives. In the objects of the Committee, as set forth on your sheet, one thing which you wish to know is why complaints are never made by operatives working in the French or dry process or in humid worsted rooms. I epitomise that by saying that it is for the following reasons: namely, that in the worsted spinning and drawing processes the maximum standard of artificial humidity is never attained, and in the French or dry process is seldom, if ever, attained; that such rooms are usually loftier, thereby allowing the impure air to rise well above the breathing point of the workers; that there is not therein that stagnation of air that there is in cotton weaving sheds, owing to the movement of air caused by the high speed of the pulleys, belts, etc.; that there is an absence of the offensive taste and smell which invariably pervades the cotton cloth shed atmosphere, and which, whilst not perhaps actually injurious, is somewhat sickly and depressing; that the operatives have a larger cubic air space; and that the results of analyses of air samples show a lower percentage of CO₂ than prevails in the cotton cloth sheds; and that, even if there were grounds for complaint, the spinning operatives not being so well organised, it is doubtful whether, even if they had any real ground for complaint, their grievances would become so publicly known.

5311. (*Mr. Thomas.*) Tell us, very shortly, what is the necessity for having only two degrees between wet and dry at a temperature, say, of 80°?—I am afraid I cannot give any answer on that point. The standard was fixed before I took charge of the district, and I am not aware what evidence was adduced to the Secretary of State upon which he based the issue of the Order.

5312. But I understand you to say, in your evidence, that from your own observations the difference between the wet and the dry bulb would average eight degrees. I think that was one statement which you made?—It is not my own opinion; that is what the figures show.

5313. You have the figures there?—Yes. It was five I think; it was not quite so great as you said.

5314. I was struck with the figure eight. You say it is five then?—Yes.

5315. Then it is quite evident from that that, although the regulations say they are allowed to go

within two, they scarcely ever get above five on the average?—That is so.

5316. (*Mr. Hartley.*) You spoke about the offensive taste and smell in cotton factories. Has that been your experience in this district, that in the cotton factories you found an offensive taste and smell?—I have—distinctly so.

5317. Do you think that prevails, that it is extensive?—Yes. That has always struck me as being rather an important factor in the use of it, as being somewhat depressing and objectionable, but I am not sufficiently conversant as to the constituent parts of the size to say whether it is actually injurious to health.

5318. Would you think that it arose from flour, say, that had been decomposed and then used as size—fermented?—Yes. I should think that is a possible cause.

5319. You are quite sure you have found it in the weaving shed and not in the dressing room or the sizing room?—No. I have felt the presence of it in the weaving shed, not so prominently as one would find it in the other departments you have referred to.

5320. Are you certain that the smell you have noticed has not always accompanied heavy sizing?—I have made no inquiry as to the relative quantity used, or for what purpose. That is simply my impression gained in inspecting the mills. Of course, it struck me perhaps greater than a man who is constantly visiting cotton mills, because by comparison I can perceive a marked difference in the state of the air as compared with my worsted mills.

5321. Of course, there is a smell that may be a little objectionable to people who are not constantly amongst it. In every weaving shed there is the smell that comes from the tallow which is used; but I take it you were referring to more than that—that there was really something very offensive?—No, I should not say very offensive. I use it in a very modified form. I thought amongst the conditions that was one of the disadvantages.

5322. Still, if it is something you can taste it must be pretty offensive. You not only smell it, but you taste it you say?—I have done both—I can both smell it and taste it. I can detect a distinct difference in the atmosphere as compared with my worsted mills.

5323. You have both humid and non-humid factories under your supervision?—Yes.

5324. Do you find that the humid factories are mostly confined to districts where they are producing heavily-sized goods?—That I do not know.

5325. You have no evidence on that?—No, I have not made any comparisons as to the thickness or thinness of the material being used.

5326. Still your impression is that wherever artificial humidity is used you get better results in weaving. You find less broken ends, you say; you get better cloth?—I do not say that as a commercial expert. I take that from the common knowledge which is given to me by principal manufacturers and managers.

5327. You have no particular district in your mind, have you? You are not thinking of Barnoldswick?—Yes, I take Barnoldswick and Earby as being the ones on which my experience is based.

5328. And you have found there in those places the offensive taste and smell you speak of?—Yes.

5329. Are there any humid factories at all in Earby and Barnoldswick?—Yes, five out of the six.

5330. Humid?—Yes, humid cotton weaving sheds.

5331. At Earby?—Four at Earby, I think, speaking from memory.

5332. And one at Barnoldswick. It does not much matter?—There are five at Earby and Barnoldswick. I know four are at Earby, possibly the whole five.

5333. Are they using them?—Yes.

5334. (*Mr. Cross.*) I think you spoke about it being beneficial to the operatives. Is that from information obtained by direct conversation with them, or from statements you have heard from other sources?—I have simply endeavoured to take a fair impartial view of

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the advantages and disadvantages which my experience taught me accrued from the use of artificial humidity, and I epitomise them in the statement that I have made.

5335. But you have not been in actual contact with any of the operatives as to whether they have felt any predisposition in any way to any ailment?—No, I have had several conversations with officials connected with the Weavers' Association, but no complaint has ever been made to me of any disastrous or injurious results arising therefrom.

5336. Have you any figures that would be indicated by a medical officer of health in any part of your inspectorate, which refer to the textile workers?—No. That was my difficulty, as I said in these remarks, that the only man I could have relied upon and had hoped to produce was the certifying surgeon for the Barnoldswick district, and he died last week. I know he had fairly strong views on this subject.

5337. Has he at any time issued any statement in regard to it?—Not officially. I think it is more in general conversation that he has expressed his views as to the results of the use of artificial humidity.

5338. Have you at any time taken a test to satisfy yourself, by stopping inside these humid sheds any length of time, to find out as to whether the humid heat was oppressive to you or otherwise? I am speaking of the summer months in particular?—I have never gone specially for that purpose, but from the results of my eight and a-half years' experience that is the impression that I have formed at the mills.

5339. Oppressive?—Yes, I have felt them to be oppressive. One did not breathe apparently with the same ease and freedom that one does in the worsted mills here.

5340. You are speaking of humid sheds?—Yes.

5341. How have you found it in the non-humid sheds? I am still speaking of the hot months of the year, the hot period of the year?—I have not perceived the same objectionable odour, and the atmospheric effect upon me has not been anything like the same in the dry weaving sheds, but I am bound to confess that the results of the air samples taken in non-humid sheds are very bad when compared with the humid sheds.

5342. Much higher CO₂?—Much higher CO₂. The results have been very alarming to me. That is one of the advantages that I think the cotton cloth worker gets.

5343. You felt it was more oppressive in the humid sheds than in the non-humid sheds?—I did.

5344. Even though the CO₂ was much higher?

5345. (Mr. Hartley.) We have not had the figures for the CO₂ in the dry sheds.

5346. (Mr. Cross.) I was leading up to that. He says they are much higher.

5347. (Witness.) I have not got the details of the figures, I can only say they are considerably higher. The results have been a source of very great anxiety to me, and improved ventilation of a mechanical nature has been insisted upon. I did not read that portion out. It is perhaps rather interesting. The results of air samples taken in dry weaving sheds are not by any means so good as those taken in the humid sheds, notwithstanding that some of the sheds are modern, and well equipped with apparently adequate mechanical ventilation. Possibly the Committee will have come to the conclusion that — Shed, — which you visited on Wednesday, was a fairly up-to-date modern shed, fitted with good mechanical ventilation; and yet the result of the last air sample, taken on December 12th, 1907, showed 23·4 of CO₂.

5348. (Chairman.) At what time of the day?—I have not the time with me.

5349. (Mr. Hartley.) Was it working?—Yes, they are always taken when they are working.

5350. (Chairman.) It all depends on whether the gas was burning?—No gas was burning.

5351. No artificial light at that time?—None. It would be taken in some part of the day.

5352. (Mr. Thomas.) December 12th. It is perhaps the darkest week in the year?—My record would show whether any artificial light, such as gas, was being used, but I should say it was not.

5353. (Chairman.) It is of importance to know that.

5354. (Mr. Thomas.) It would have been lighted in the morning by the gas.

5355. (Mr. Hartley.) Did you take those figures yourself?—I did not analyse the air, but either I or my junior took them.

5356. It is very unlikely you would get there much before noon?—No. I should say they would be taken between eleven and four, certainly. We are careful in taking them.

5357. (Mr. Cross.) That is in the new shed?—That is in the new shed of —. The figures have been better. That was a point—the variableness of these results of air samples. Whilst on the whole the air samples have been very valuable to us, and have materially strengthened our hands in enforcing better ventilation conditions, because where arguments have frequently failed, the facts revealed by the figures have frequently forced unwilling firms to take remedial measures, still the results have been of great variance on certain occasions.

5358. (Chairman.) You are talking of the place we went to?—Yes.

5359. I think at the time we were there there were fans running?—Yes.

5360. Were those fans running then, or have they been put in since?—They were all running at that time. This is the worst result we have had, we have had much better results. But that is the extraordinary thing, that at the same mill you get a varying result from the normal internal conditions; and that leads me to the point as to whether one ought to take the velocity of the outside air into consideration in taking these samples.

5361. (Mr. Hartley.) This is very important evidence for us that we are getting on the dry sheds, and if Mr. Seal has any records I think we ought to have them. —I should be glad to supply them to you. I can only tell you they are infinitely worse CO₂ results in the dry weaving sheds than we have had in the humid sheds.

5362. (Chairman.) Can you let us have a return for the dry sheds of the CO₂?—Yes.

5363. (Mr. Hartley.) You cannot say with any certainty what the average amount of CO₂ would be in the dry sheds?—No, I could not say offhand.

5364. (Mr. Cross.) You or your junior took the sample at —?—Yes.

5365. May I ask what is the mode? I mean was it taken at a certain height from the floor, or was it on the floor?—All the conditions laid down by the chief inspector with regard to the taking of air samples for analytical purposes by the Home Office were duly observed, and very strictly.

5366. You satisfied yourself the water used for steaming purposes was pure and fresh?—In my district inquiries have been made in every case.

5367. Could you tell us whether it is the town's water—the town's supply—or a river, or a lodge, or what it was. Where was the water taken from?—I could not say with any accuracy or definiteness. I can only say this, that those regulations have been carefully gone through with the manager or the occupier, and they have assured us that the water was from a pure source.

5368. You are sure it was so?—Yes.

5369. Had you the steam boiler separate altogether for infusing steam into the shed. Was the water sent into a boiler away from the driving boiler?—I should not like to say at this length of time from when my inquiries were made. I should not like to say definitely on that point. The results of an air sample taken at Messrs. —, where you went on Wednesday, showed 6·6 in December, 1906. In December, 1907, it showed 26·4. This was so very extraordinary that I communicated with them and instructed them that the condition of the shed would have to be very much

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improved. Then there was another in March of this year, and it comes down again to 6·5.

5370. (*Professor Lorrain Smith.*) What was the date of the first?—December, 1906, 6·6. With the same fans running and apparently the same ventilation—possibly there might have been a few stopped up, I could tell by my records—in December, 1907, we got 26·4, which of course was a terrible result, and in March, 1908, when my inspector went with a view to possibly taking proceedings unless things were very much better, we got back again to 6·5. Whether there had been any slight error in taking the sample in December last year I cannot say, but the figures were such that one could scarcely credit them.

5371. (*Chairman.*) It all comes to this, that you have records, and you are going to supply them.—Yes.

5372. That will be much more satisfactory than anything else?—Then you require from me the records of the percentage of CO₂ in dry weaving sheds.

5373. In the dry weaving sheds?—When last taken.

5374. The longer the period the better?—If there have been two samples taken, they will be supplied to you

5375. The more information on the point, so long as it is reliable, the better.

5376. (*Mr. Cross.*) And the source of the water supply.

5377. (*Chairman.*) If you could give some sort of a general idea as to the sources.

5378. (*Professor Lorrain Smith.*) You spoke of a minor advantage, that some workers seem to feel relief from pulmonary trouble when working in humid sheds as compared to dry sheds?—Yes.

5379. What forms of pulmonary trouble had you in mind?—I have no special form. I have always been told whilst in this district that if people suffer from asthma, bronchitis, or any pulmonary or chest trouble, they can work with greater ease in these sheds where artificial humidity is produced than in the others.

5380. (*Mr. Hartley.*) Have you formed any opinion as to which is the better way to ventilate a dry shed—whether by exhaustion or by the plenum system?—No, I have not. I have not got those systems in this district. We have the exhaust system, but the system we are putting in now, I think, is one which can be converted either way.

The witness withdrew.

Mr. A—— G——, called and examined.

5381. (*Chairman.*) What are you by trade?—A weaver.

5382. Where do you work?—Messrs. —, —

5383. Is that a dry shed?—Steam.

5384. It is an artificially humidified shed?—Yes.

5385. How long have you worked there?—I have worked there since I started working—since I was 12 years old.

5386. And you are now 25?—I am 40 yesterday.

5387. What kind of artificial humidity do they use there?—They come out of those big pipes—air and steam.

5388. Have you ever worked in a dry shed?—Never in my life.

5389. Have you ever suffered any discomfort in consequence of the humidity?—I do not know whether that has been the actual cause of it, but I have blamed it sometimes when I have suffered from rheumatics.

5390. You have thought that might possibly be the cause?—I thought that might possibly be the cause.

5391. Have you ever been off work with rheumatics?—Yes.

5392. For how long?—I was once off for six weeks.

5393. Did you see a doctor?—Yes, I was under the doctor.

5394. What was the doctor's name?—It was a Dr. Wylie, that time. He is dead now. At Skipton.

5395. What did he tell you you were suffering from?—Rheumatics.

5396. He told you you were suffering from rheumatics?—Yes.

5397. Did he attribute it to any cause?—No, he did not say anything as regards that.

5398. What class of warp and weft do you use there? Is it a high class or medium?—Medium.

5399. Do you have many breakages?—What do you mean by that?

5400. Do the ends break?—Well, in our class of goods it depends a lot upon the weather. If it is a very dry day it makes them weave worse.

5401. Then you put on a bit more steam, I suppose?—Well, I will not say that they put in more, because you know there are the thermometers to go by and to keep by, I suppose, but they weave worse without it, I suppose.

5402. Your class of goods, on a dry day, would weave worse without it?—Yes, under the present conditions.

5403. Without the artificial humidity?—Yes.

5404. Are you a piece-worker or a day-worker?—A piece-worker.

5405. Supposing somebody said, "Now would you like them to stop altogether using humidity in the shed," what would you say?—I should agree with it.

5406. And you think you would be more comfortable?—I never saw anything comforting in dampness myself.

5407. Of course, we only want your own opinion. We are just asking you for your opinion?—I quite understand.

5408. You say that you would rather be without the moisture?—Yes, if they could make the conditions as you could earn your wage.

5409. I am coming to that?—Of course, if they had to do without the steam they would have to alter something as they could do, you know.

5410. Does that mean, supposing they did away with the steam they would have to give you a bigger wage?—No, they would have to alter the class of work, make the work better so that it would stand the dry atmosphere.

5411. To get a better class of warp and weft?—The warps. It does not interfere with the weft. It is the sizing really which they put into the warps. It dries up with the dry atmosphere. It is the class of goods.

5412. Then supposing that they stopped the moisture and still used the same class of goods that you are using now, how would that affect your wages?—It would affect them a good bit.

5413. Can you form any opinion how much a week it would be?—Between good work and bad. It can drop one quarter directly.

5414. How many looms do you take?—Four looms.

5415. Do you mind telling us what you make a week on an average?—About 23s. or 24s. That is when there is a proper class of work.

5416. Supposing that there was no humidity, what would it drop to, say, in a dry week?—Under the present conditions it would drop 5s.

5417. As much as 5s. in a week?—Yes, it could do.

5418. What about the heat in the very hot weather. The shed where you work is pretty high up?—It is not one of the highest.

5419. In the summer, do you suffer from any great feeling of depression—a feeling that the heat is so great?—The steam will bring that on for one thing. The steam will bring that feeling of depression.

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5420. That is in the very hot weather?—Yes, in the very hot weather.

5421. How about the winter, when you have got all the gases lighted?—It is just comfortable then, you might say.

5422. In winter it is comfortable, but in the summer you suffer discomfort. Do I understand that to be so?—Yes, but there is a lot of steam used.

5423. (*Mr. Thomas.*) Supposing we put it to you this way, that with your present system of steam, as you call it, you are making 23s. or 24s. a week. If steaming were to be abolished, so that you could still earn 23s. to 24s. per week, which would you prefer—the steam or dry?—I should prefer it without.

5424. Can you tell us, in a short sentence, why?—Because the conditions would be pleasanter.

5425. You think they are pleasanter in the dry shed?—Yes, it must be.

5426. It must be?—That is my opinion.

5427. You have never worked in one?—I have never worked in a dry shed.

5428. You think it would be?—Yes, I do.

5429. Now, supposing that you could not earn exactly the same amount of money, do you think that you would prefer to have a dry shed?—I would sooner sacrifice a little, but a working man cannot afford to sacrifice a lot, especially when he has somebody else dependent upon him. That is the condition.

5430. Do you get very hot in summer time in your shed?—Yes, it gets very hot sometimes.

5431. I am not referring to last year, because we had not a summer last year; it was a mild winter?—In a hot summer, when the steam is used, it does get hot. As the Chairman was saying, it brings a kind of depression, you feel weary.

5432. Do you remember us being there?—Yes, I saw you.

5433. What do you think about the condition of the shed that day?—Well, that day I should say as regards heat that it was just comfortable.

5434. Just nice?—Yes.

The witness withdrew.

Miss M— H—, called and examined.

5446. (*Chairman.*) Are you a weaver?—Yes.

5447. Do you work with —?—Yes.

5448. How long have you worked there?—About three years.

5449. Were you a weaver before you went there?—No.

5450. You learned the trade there?—Yes, I learned the trade there.

5451. Have you worked there all the time?—Yes.

5452. You never worked in any other weaving shed before?—No, I never worked in a weaving shed before.

5453. How many looms do you mind?—Four.

5454. Do you enjoy good health as a rule?—Yes, I enjoy good health.

5455. Do you feel any discomfort in the work at all? Take a very hot summer day. I suppose it gets very hot?—Yes, it is very hot in summer.

5456. And I suppose in winter sometimes, when they light the gas, it gets a bit hot?—No, it is not very hot in winter.

5457. You have what they call artificial humidity, or steam coming in through pipes?—Yes.

5458. Do you like that or not?—I think it would be better without it.

5459. You think you would be more comfortable without it?—Yes.

5460. Would the weaving be as good. Would you turn out as much cloth?—Not as we are now, we should not.

5435. You do not think there was too much steaming or too little?—No.

5436. Would you prefer it to be even less?—Well, you see now and the middle of summer makes a great deal of difference.

5437. But I am speaking of when we were in. Would you prefer to have less steam or more steam?—As regards the humidity there is a difference between having steam in the dry pipes and those—keeping the place warm. There is a difference there. When a man is working and depends upon his occupation to keep himself warm that is different. It is not the same as being a navvy who can keep himself warm in cold weather; you want to keep warm.

5438. Do you feel any effects when you get outside—say on a very hot summer day when you have been in this steam?—Yes, you will get cold if you do not mind.

5439. You will get cold, in summer time even?—Yes, in summer you will get cold—more so then, because as a rule you are not as careful as in winter.

5440. What about winter time then, when you are working, say, at 56° or 60°, and you go outside when it is freezing?—Well, you see in winter you do not sweat, they have not that amount of heat. In summer you do. In summer when you go out, say you are sweating, if you get into any kind of a draught you are apt to catch cold. There is the difference.

5441. (*Mr. Hartley.*) You say you have no experience of working in a shed where there is not steam?—No. I have worked there all my life.

5442. Of course you cannot make a comparison?—No.

5443. But in the hot weather when the steam comes in you have felt discomfort?—Yes.

5444. Have you ever looked at the thermometers yourself?—Yes, many times.

5445. Have you noticed, when you began to feel that discomfort, what they were reading?—You see I have not gone when I have felt that way—not exactly, but I have looked, and it has been very hot.

5461. You say as you are now. What change would you have to make so as to turn out the same, if the humidity was stopped?—They would have to bring better work in than what we have now. It would not weave as well without steam.

5462. You mean that the warp would have to be better warp?—Yes.

5463. So that the ends would not break so much?—Yes.

5464. In cold days, and when the wind is in the north or east, the ends break more than on days when it is not so dry?—Yes.

5465. And you would rather be without steam?—Yes, I would rather be without it.

5466. And would not you lose some money for wages?—I daresay we should.

5467. You think you would lose some money?—It does not do for everyone the same. It has not made any difference to me yet. I have not been there so long yet.

5468. But you say it does not do for everybody. Have you heard other workers complain about it. Do they say that it makes them ill in any way?—It never harms me.

5469. What makes you think that it does not do for some workers?—The damp warps, it is like to damp you as well. It is bound to make a difference to some of them.

5470. If it damps the warps it will damp you as well?—Yes.

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5471. (*Mr. Thomas.*) Do you know why they put steam in?—For anything I know it is to weave better, but I do not know. I do not understand it.

5472. You think it is for that?—I think it is for that.

5473. Does it make it weave better?—Yes, it makes it weave better. I will say that.

5474. Does it make them weave better in summer time?—I cannot say for that.

5475. How do you feel in summer time. Do you get very hot?—We get very hot in summer time.

5476. And is a lot of steam put in then?—Not so. very much.

5477. But supposing they did not put steam in, do you think it would be more comfortable in summer time, when it gets very hot?—Yes, more comfortable.

5478. Take winter time, when the shed is rather cold. Does it make it uncomfortable then, putting steam in?—No, it is not so uncomfortable then, but it is not very cold where I work in the winter.

5479. Do you remember us being there?—Yes.

5480. You saw us come through?—Yes.

5481. What sort of a day was that? How did you feel then? Was it all right, or too hot, or too cold?—It was not too hot, and it was not too cold; it was just nice.

5482. Do you feel any draughts through this steaming arrangement?—No, I never do.

5483. Do you work anywhere near one of these instruments?—No.

5484. The steam is carried along a long trunk?—Yes.

5485. There is no buzzer about the place?—No.

5486. Suppose that they did away with the steam. Would you prefer that the steam should be done away

with and that you should have less money to draw?—No, I would not.

5487. You would sooner have the steam and more money?—Yes, it does not make any difference to my health.

5488. (*Mr. Hartley.*) What makes you think steaming is not a good thing. You say it is harmful; what makes you think so?—It is all right in winter, but it gets very hot in summer.

5489. But you say you believe it is a very bad thing for people. What makes you think that? You say you have not felt it yourself?—Well, I have known people come to the shed and they had to go away; they could not stand the steaming.

5490. Was that because of the heat, do you think?—It was the steaming did it.

5491. They put steam in, you know, to moisten the air, to damp it—not to heat it?—Yes.

5492. Was it heat they complained of, or the damp?—The damp.

5493. You are sure?—Yes, I am sure.

5494. Have you ever felt any discomfort from this steaming in summer time particularly as against winter?—No, I have not.

5495. It has not been oppressive to you, has it, in summer time?—No, it has not.

5496. You would be working there two years ago in August?—Yes.

5497. Do you remember that very hot time in August?—Yes.

5498. Did you feel too hot then?—Well, it was hard.

5499. You did not feel like fainting?—No.

5500. You were not oppressed with it?—No.

The witness withdrew.

Mr. J— S—, called and examined.

5501. (*Chairman.*) What are you by profession?—Cotton weaver.

5502. How long have you been a weaver?—About 54 years.

5503. Where have you worked chiefly?—I have worked as far as 20 years at one firm.

5504. Where was that?—It was not 20 years exactly. That would be —, in — and —. I worked there longer than with any other firm.

5505. And where do you work now?—I work for —.

5506. And how long have you worked for them?—I have worked for them ever since I went to —. That would be just over two years.

5507. That is a dry shed?—Yes.

5508. Have you ever worked in what is sometimes called a wet shed, where artificial humidity is introduced?—No.

5509. You never worked in one of those?—No, only once they tried a bit of an experiment, but it was only a trifle. They put a few jets what you may call down the main alleys. Of course, I do not call that fairly steaming—just for an experiment.

5510. How long did it last?—They only put it in this way. We will say it came on like a dry east wind, or something of that kind, they would just put them on.

5511. Did they keep them on? Were they used on the dry days right through? You said it was an experiment?—Yes.

5512. Did the experiment succeed, or was it stopped?—I do not think it suited them particularly. It only just touched certain parts. It was only on what we call the main steam pipes as were put in for the warmth of the shed—just boring a few holes in

and letting it out. That was all they tried in that place.

5513. How long did they go on with it. You said it was an experiment?—I cannot tell how long they went on with it. I left when — started on new shed, and it is possible they might have them on yet for anything I know.

5514. For all you know they are going on now?—They are. That is all I know.

5515. How long did you work in that shed while they had the steaming?—About two years I believe.

5516. Did you like the steaming or did you dislike it?—It did not take any effect upon me. It was too far off. I felt no benefit or aught in any shape or form from it.

5517. You felt no benefit?—No benefit nor otherwise.

5518. You could form no opinion about the people who were near it?—No. Well, in fact, there was that little on it made very little difference to either the people or the weaving—there was that little of it.

5519. Where you work now there is no humidity?—No.

5520. You spoke a short time ago about east winds and cold winds. Of course you have east winds and cold winds sometimes now?—Yes.

5521. How about the weaving now. Do you find any difficulty in weaving under those conditions?—Not as much as I have found at some places.

5522. Not as much?—No. You see it is here, at the place I am working at, mostly what you may call coarse reeds—coarse twist and coarse weft; we will say for 40s. reeds up to 70s.—the majority is about 40 or 50 now—and 16s. and 17s. weft, as low down as 12s. You see they are very different to these finer sorts. East winds do not take as much effect upon them as they do upon finer counts.

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5523. Then as a matter of fact you do not find any serious inconvenience from the east winds?—No.

5524. Do you find your shed a comfortable place to work in. Is it comfortably warm, or is it too warm, or is it cold. How do you find it?—It is the best shed, speaking honestly, that ever I have worked in. It is really.

5525. It is comfortable?—Yes. You know you cannot have things perfect, not fairly. In winter time when it comes on cold we do feel cold many a time in the morning in winter time, but in summer time I have been at places where it has felt a lot hotter than what it is yonder.

5526. You say that you cannot get perfection, but it is as near perfection as you can reasonably hope?—What I say is this. Honestly speaking it is the best shed that ever I have wove in in my life, as regards air space, pure air, and all such things as those.

5527. Could you improve it in any way?—I could not improve it—not in my town.

5528. Your own shed?—You mean if I had to bring any suggestion for improvement could I improve it?

5529. Yes?—I do not know that I could fairly. I have thought of this, that if there were a few ventilators more—we have those fan ventilators bear in mind—in summer time when it is so hot I have thought one or more of them would be an improvement. Now I have looked at it this way. When it comes on winter time, and them going, it would happen make it colder.

5530. Too cold?—Yes.

5531. But supposing that the air which came in was warmed a bit?

5532. (Mr. Hartley.) It is the exhaust system. They take the air out of the shed?—They take a lot of air out and then they take a lot of dust out. That is a means of purifying the air.

5533. (Chairman.) We will talk about the summer first. Supposing that you had a few more fans running in the summer, do you think that would make it better?—I do really.

5534. Would you suffer from any draught?—There is not the least draught comes from them. I do not work right under one, but I have heard them say that do that they cannot feel anything as regards the draught coming.

5535. They do not feel any draught?—No, it all seems to go up.

5536. Then supposing in the winter it got cold, there would not be much difficulty in asking them to stop two or three of them?—No, there would not.

5537. (Mr. Thomas.) Do these fans run in winter time just the same as they do in summer?—Yes.

5538. In exactly the same way?—Yes.

5539. The same speed?—Yes.

5540. The same number of fans?—Yes, the same speed. They are just run off the same shaft. There might be one or two that are knocked off, but if there be, of course I do not know. I have seen one or two slackened off, but I have thought it was on account of their being too slack, that they have worked off themselves. But there is this. When they are running they take a lot of dust out of a place and they can feel no draught below—it makes the air purer.

5541. How do you warm the place. Is there a big steam pipe running round or what?—We have something like five rows of steam pipes up and down—about five rows.

5542. And what number of looms have you?—About 900 looms.

5543. Does it get very warm in summer time?—In summer time. But you know that is not when steam is in.

5544. Do you remember two years ago when it was very hot. Was —'s place running then?—Yes, it were.

5545. Do you remember August, 1906?—Yes.

5546. That was a very hot month?—Yes.

5547. How did you go on?—I went on this way. I was not as hot as what I was in the shed I came out of. The air was considerably hot.

5548. Your shed is more lofty than it was before?—I believe it is a trifle higher. I believe so. I have not paid particular notice, but I believe it is a trifle higher.

5549. But you think that in your opinion your shed was as cool as any other shed in your town?—I will guarantee that there is not a shed in the place that is as pure.

5550. And as cool?—And as cool. I worked at another shed two years, in summer time mostly, and there is a lot of difference between the two sheds during the heat.

5551. If it gets cool in summer time, how do you get on in winter time with these fans going on exactly in the same way. Is not it very cold?—It is pretty cold in winter time when the cold weather is on.

5552. (Chairman.) They give you a bit more steam, I suppose, in the winter?—When it is very cold weather it is a different thing to warming the shed all the way through.

5553. (Mr. Hartley.) Does not the great cold make it weave worse?—Well, it does at a lot of sheds.

5554. Does not it at yours?—It does not make a great lot of difference from what I have seen at other places that I have been at, on account, do you see, of being coarse reeds and coarse twist. It is not as bad for coarse reeds and coarse twist as for fine reeds.

5555. Are you sure you worked at this present place in August, 1906?—Yes.

5556. Nearly two years ago?—Yes. It is over two years since they started, and I started when they started.

5557. You had those fans working, I suppose?—Yes.

5558. Two years ago, in August?—Yes.

5559. Has this other place which you came from, — fans in, too?—No, only simply the old-fashioned ventilators.

5560. On the roof are they?—Yes.

5561. Not opening windows?—No. Bear in mind they adopted opening part of the windows just before I left, they were that much complaining, were the weavers, it being so hot. These ventilators did not seem to be of any good much in hot weather.

5562. Never mind that. Let us go on with this point about the coolness. You say that this shed was cooler than any you had worked in in summer?—Yes, this that I am at now.

5563. Do not you think that is due to these fans being working?—I fancy it is, but I have never worked where there have been fans before.

5564. The fan takes dust out, you say?—I think it does—a lot of it.

5565. Have you noticed that the dust is in the atmosphere, being lifted up from the floor by the fans?—No, I have never seen it visible.

5566. But have you never seen a haze over the place, a kind of haze—hazy like?—I can tell you all I have seen is this, that when the fans which have been working round are stopped—I have noticed them at meal times—they have been all covered with dust. That makes me think that they take a lot of dust out. It might not be so. Do not depend on what I say. I am going by what I have seen. They seem to be all covered with dust, and I think that is the reason; the dust flies up and they get it out.

5567. We were in the mill on Wednesday, and you would see us?—Yes, I did.

5568. Is it a very dry shed?—It is not as dry as some. There is this about yon place of ours. Under all of the looms, if you have noticed, there are bricks instead of flags.

5569. I was coming to that. Just follow me, and I will take you over the points, if you will. We noticed that the flags were very dry in that shed?—Yes.

5570. Have you noticed that?—Yes, they are.

5571. They are perfectly white and dry?—Yes, they are dry.

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5572. There is no moisture coming through?—No, there is no moisture coming through the flags.

5573. Underneath the loom you have bricks laid?—Yes.

5574. I also understand that you have pipes laid along the floor so that you can run water into those bricks?—No.

5575. Have you no means of degging the floor?—Yes, in case it comes dry, I have seen it in some places they went with buckets to swill the floor with. They have a pipe, and they then put the india-rubber hose pipe to it and they can deg the floor if they want.

5576. They put it underneath the loom?—Yes.

5577. Why do they do that?—Very likely because it comes to be so dry, and happen they think it will weave better.

5578. Do you think there is any connection between the fans which are taking out the air and what they are doing at the floor. Do you think that the fans being working make the shed drier?—I am not an ex-

perienced man for that sort of thing, but it looks as if it will not make them wetter, does not it?

5579. I will put it in another way. Perhaps I can make you understand. You have worked in other places where they had not fans?—Yes.

5580. Have you never felt a kind of sticky feeling in the atmosphere, a kind of moist, sticky, close feeling?—Yes, many a time.

5581. Do you never feel that where you are now?—Not to the extent I have done before.

5582. That sticky feeling, we say, is moisture, and with working the fans you are taking it out. Now, what I wanted to know from you was, whether this system of degging the floor was the consequence of having the fans working above. You do not know, you say?—I do not think there is anything of that to do with degging the floor—not at all. Of course, there is a difference in weavers. There are some will think, "Well, I will get a bucket, and I will send a bucket of water under my loom; it will make it do better." That is their idea when they do it that way. There are others who never send any at all under.

The witness withdrew.

Miss A— H—, called and examined.

5583. (Chairman.) Are you a weaver?—Yes.

5584. How long have you been a weaver?—Eight years.

5585. Have you worked all the time in the same place?—No.

5586. Where did you work before?—The —.

5587. And you are now working for?—.

5588. How long have you worked for —?—Going on for six years.

5589. How long did you work in the other place?—Two years.

5590. The shed you are working in now is what is known as a dry shed, is not it?—Yes.

5591. There is no artificial humidity, no steaming?—No.

5592. Do you know what I mean by steaming?—Yes.

5593. Had they any steaming in the place you worked at before?—I cannot tell you.

5594. You do not remember?—No.

5595. Do you know what I mean? That is sending steam in to make the air a little more moist?—Yes.

5596. Especially on dry days, to make it weave better. Had you any steam of that sort in the last place?—Not that I know of.

5597. You do not remember?—No.

5598. (Mr. Hartley.) You did not see it?—No.

5599. (Chairman.) If it was there she would know about it, of course. Is the shed you work in now comfortable?—Yes.

5600. There are some fans?—Yes.

5601. Do you like the fans?—Yes.

5602. It make it cooler in summer?—Yes.

5603. What about the winter. Do you find any inconvenience from them in the winter?—No.

5604. Any complaints of draughts?—No.

5605. In fact, you think they are good things?—Yes.

5606. Does it sometimes get very dry in the shed for weaving. I mean do the ends break much in very dry weather?—No.

5607. You do not get trouble with the ends breaking?—No.

5608. Do they ever damp the floor at all?—Yes, in the summer.

5609. Not in the winter?—No.

5610. They never take a pipe and wet the bricks or anything of that sort in the winter?—No.

5611. Only in the summer?—Yes.

5612. What do they do in the summer?—I do not know.

5613. Does it weave better when they do?—Yes.

5614. I suppose that is to make it weave better. You find the shed comfortable, you say?—Yes.

5615. How many looms do you mind?—Four.

5616. You can do that comfortably?—Yes.

5617. In fact, so far as weaving goes, you are comfortable and content, I suppose?—Yes.

5618. (Mr. Thomas.) You say you have worked for — six years?—Yes.

5619. You worked for him, then, in the other shed?—Yes.

5620. What shed was that?—.

5621. Which of the two sheds do you prefer?—The present one.

5622. Why?—It is more comfortable.

5623. Do you mean the conditions under which you work are now more comfortable?—Yes.

5624. That the atmosphere is more comfortable?—Yes.

5625. Is that on account of the fans?—I think so.

5626. (Mr. Hartley.) Do you feel fresher than at the last place?—Yes.

5627. You never feel too cold in winter?—No.

5628. You feel no draught from the fans?—No.

The witness withdrew.

Miss L— M— B—, called and examined.

5629. (Chairman.) Are you a weaver?—Yes.

5630. How long have you been a weaver?—About three years.

5631. Have you worked all the time in the present shed?—No. I have been there about 12 months this Whitsuntide.

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5632. Before that where did you work?—In —.

5633. Whose works?— —'s.

5634. Was the first place you worked at a dry shed? I should explain by "dry shed" we mean a shed where no steam is let in to make the air moist?—Do you mean the pipes so that the steam cannot get out?

5635. Yes?—Yes, it was a dry shed.

5636. The pipes were just for heat?—Yes.

5637. And the steam did not get out?—No.

5638. There was no moisture let in in any way?—No.

5639. Was it a comfortable shed to work in—the first one you were in?—Yes, it was comfortable.

5640. And what about the present one. Is the present one comfortable?—Well, I think it might be more than what it is.

5641. It might be warmer?—Yes.

5642. (*Mr. Hartley.*) Where are you working now?— —. The one I work at is the new shed. The shed is cold.

5643. (*Chairman.*) Are there any fans for ventilating that shed where you work?—I do not understand you.

5644. By fans I mean those things that go round?—No, there are no fans.

5645. What ventilation is there in the shed? Are there any windows which open in the summer?—No.

5646. How do they let the air in in summer?—There are no windows that I have seen.

5647. Is it very hot in summer?—No, it is not hot in summer. It is very cold in winter.

5648. Are there any steam pipes?—Yes, there are steam pipes. The steam does not come out of the pipes. It is just steam through the mill, but not the pipes with holes in.

5649. And the steam makes the pipes hot and that heats the air round about?—Yes.

5650. You say it is cold?—Yes, the temperature this morning was 40°, and yesterday morning it was 45°.

5651. At what time?—It would be about half-past seven or seven o'clock.

5652. And you began working at what time?—Six.

5653. At half-past seven you say the temperature was what?—40°.

5654. And when was it 45°?—Yesterday morning—I could not tell that time.

5655. About what time would you say. Before breakfast or after breakfast?—It would be after breakfast.

5656. Are you quite sure it was 45°?—Yes.

5657. It would be very cold?—Yes, it was very cold this morning. Other weavers have complained besides myself.

5658. (*Mr. Cross.*) Where did you see that registered?—They have a thermometer in the mill.

5659. (*Mr. Thomas.*) Can you read it?—The over-looker to me read it.

5660. (*Mr. Hartley.*) This is a mill in which nearly all the looms are stopped?—Yes, there are a lot of them stopped.

5661. I should think there is not above a quarter of them running?—No, there is not.

5662. Would that have something to do with it being so cold, do you think?—I do not know. It was cold before all the looms were stopped.

5663. (*Chairman.*) Do the ends break very much in the cold weather?—Well, they do not go so very bad.

5664. (*Mr. Hartley.*) The roof is very lofty?—Yes.

5665. It is the new shed you are now working at?—Yes.

5666. And it is a very lofty roof?—Yes.

5667. And it would require more heat on that account?—Yes.

5668. Do you say that all through winter you have to work at 40° or 45°?—I do not know that it has been all through the winter, but yesterday it was 45° and this morning it was 40°.

5669. And the steam was in?—The steam was in. It is cold in the shed we work in. I have worked there 12 months this Whitsuntide.

5670. (*Mr. Thomas.*) Has the place been filled up?—When I have been there, yes.

5671. All the looms have been run?—All the looms have been run.

5672. Have they been run this cold weather?—Not all of them. We have been on short time now nearly six months, and we have not had four looms in the six months—running four looms.

5673. But has it been as cold all the winter as it has been this last day or two?—It has been cold, but hardly as cold as it has been the last day or two.

5674. Have you had any hot days since you worked there?—I had last summer there.

5675. Had you any day on which it was very oppressive?—No.

5676. Do you ever remember a day when it became very oppressive last summer?—No, I do not remember.

5677. We had not a summer last year?—No, we had not.

5678. (*Mr. Hartley.*) You do not remember that very hot time two years ago in August?—Yes, I remember it.

5679. (*Mr. Thomas.*) Where were you working then?—I was working in —.

5680-81. (*Mr. Hartley.*) Did you feel then very much overheated—exhausted?—No.

The witness withdrew.

Miss E— P—, called and examined.

5682. (*Chairman.*) Are you a weaver?—Yes.

5683. How long have you been a weaver?—About 30 years.

5684. Would you tell us the places you have worked in?—I worked at — first, when the weaving shed was there. I shall have been perhaps 29 or 30 years with —

5685. That is where you work now?—Yes.

5686. When you worked at the other place was it a dry shed, just the same as the one you are working in now?—Yes.

5687. They did not let any steam in for moistening the atmosphere?—It is a long time since.

5688. You do not remember?—Yes, I rather remember it was warm, because it was cotton weaving, but that shed is done away with now.

5689. It was warm. That is, they had pipes to go along to warm it?—Yes.

5690. But did they let any steam from the pipes come out?—No, I do not think so.

5691. What about your present shed. Is it a comfortable one to work in?—Yes, very good. I work in the old shed.

5692. You work in the old shed. In the winter, on this sort of cold days, is it warm enough?—It is cold in the morning, you know, and sometimes we have to put little shawls on; then we have to take them off.

5693. You find it cold?—Yes, a little cold.

5694. And in the hot weather, in the summer, do you suffer from any great heat?—I am stout, and I feel it more than the others.

5695. You feel the heat, no doubt, in the summer?—Yes.

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Miss E— P—.

5696. Have you ever been in any weaving shed where they have what they call steaming?—No.

5697. You do not know anything about that?—No.

5698. What about your ends. Do they break very much?—They will not go at our work without it is warm.

5699. They do not go unless it is warm?—We find a difficulty when the shed is cold, because it is fine work, and if the shed is warm it makes it weave better.

5700. Do you know what degree of warmth it is?—No, I have not one beside me. Well, I believe there is one at the bottom, but I never bother with it.

5701. That is a thermometer?—Yes, I think it is.

5702. You have not looked at it?—I do not bother with it.

5703. But if it is cold it does not weave well?—No, if the shed is cold there are a lot of ends to take up, and it is very fine work there.

5704. When the air is very dry on cold days do they ever throw any water about underneath?—To speak truth, I have seen the weavers perhaps put a little drop on, but not the masters.

5705. The weavers will put it under the loom?—I have seen one or two perhaps take a bucket and put a drop.

5706. Do they sometimes put a wet cloth on the beam?—Yes, I have seen that done, but I have not done it.

5707. And you get on very well without?—Yes. But this wet cloth is when it is not a good warp, to make it weave. They will not weave right in dry weather, and they will not weave right when it is cold. It might do in the summer time when it is hot.

5708. (*Mr. Thomas.*) Is this a colour place or a white shop?—We have all sorts.

5709. Does the weather affect your colour work just in the same way that it affects your white work?—No, I do not think so.

5710. Colour work is not affected so much by cold and damp?—I do not think so. I have never took that notice. I have took more notice of this fine work, and I generally get some with being an old weaver. Of course, they know I am a bit particular with it. I think I have been there about 29 years.

5711. (*Mr. Hartley.*) You have never felt overpowered with heat then, have you?—Yes, in summer time.

5712. What do they do then? Do they open the windows?—Yes, the overlookers do.

5713. But you have no fans working?—No. When it is right dusty I do not like mine opened. When the road is dusty I fancy it makes it a bit worse.

The witness withdrew.

Mr. W— W— called and examined.

5714. (*Chairman.*) Are you a weaver?—Yes.

5715. Where do you work?—At ———

5716-17. (*Mr. Thomas.*) Was it a place we went into on Wednesday?—Yes.

5718. (*Chairman.*) How long have you worked there?—Fifteen months.

5719. Where did you work before?—Blackburn.

5720. Where did you work in Blackburn?— ———, ——— Mills.

5721. And before that?— ———

5722. What mill?— ———

5723. Any one before that?—In Blackburn before that.

5724. What mill in Blackburn, then?—The last mill I was at was the ——— Mill, ———, Blackburn.

5725. You have had a pretty varied experience?—Very fair, this last 14 or 15 years.

5726. Do you understand the terms dry shed and wet shed?—I would like to hear them explained.

5727. When we talk of a wet shed we mean a shed where artificial humidity is brought in?—Blowing off.

5728. Blowing off either steam or water spray—I mean to say, water broken up to look like steam, or else steam. At any rate, when we speak of a wet shed we mean a shed where moisture is brought in otherwise than by degging; we do not mean degging. By a dry shed, we mean just where there is no artificial humidity. Have you worked in both?—Yes.

5729. Tell us first of all about the wet shed?— ——— in Blackburn. I do not call it healthy to work with steam blowing over you. I had six looms there.

5730. You worked at ———'s?—Five years.

5731. That was a wet shed?—Yes.

5732. How did they get the humidity there?—A steam jet—steam jets blowing off in about five directions.

5733. Did you like the steam, or did you dislike it?—No, I did not like it.

5734. Tell us why you did not like it?—I had not the same health I used to have before I worked there.

5735. You think it affected your health?—Yes.

5736. Did you suffer any discomfort in consequence?—Not necessarily, only I was afraid of having rheumatics, so I left.

5737. You had colds?—Yes.

5738. And you had rheumatics?—No, I was afraid of having them, so I left.

5739. Did you leave entirely on account of the steaming?—No, thinking to better myself.

5740. But still, are we to understand that you objected to the steaming?—Yes.

5741. You thought it brought on bodily discomfort?—Well, I do think so yet.

5742. And you thought so then?—Yes.

5743. When you left there where did you go?—To ———

5744. What sort of shed did you work in there?—I worked at the ——— shed.

5745. Is that a wet shed or a dry shed?—That was a wet shed.

5746. How did they get the humidity there?—They got it through the large pipes blowing out wet—not blowing out steam.

5747. Blowing out wet?—Yes, the same as fans.

5748. A long trunk going through the room?—Yes.

5749. With a fan inside the trunk which sent the air along with the moisture and sent it to the different parts of the room?—Yes.

5750. What about that place?—I stayed there four years, and that did not do for me.

5751. Did the moisture make you feel uncomfortable there?—Yes. It always will do, I think, to anybody.

5752. Which was the best, the place where there was steam or the place where they had these trunks?—They were both somewhat similar, were those two.

5753. If you had to make a choice between the two systems, which would you say was the best?—I should think that as I was at in the second shed.

5754. I suppose it got very hot in summer?—Yes, but they used to take it out in summer.

5755. They took out the steam?—The steam.

5756. I suppose they had the cold air coming in in the summer through the pipe?—I fancy they would

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have. I do not understand it that much, but I fancy they would have.

5757. Do you think it made it a bit cooler in summer?—Yes, it makes it a bit cooler in summer.

5758. After you left there what was the next place you went to?—I went to the ———

5759. What sort of a shed was that?—That is a dry shed. They used to deg there while I was there—deg the floor.

5760. Tell us something about the ——— shed. Were you comfortable there?—They were very dry, only for the degging with the degging-can—degging the floor.

5761. How about the weaving? Did you weave well there?—Well, it wove right enough while I was there.

5762. What sort of warp had you?—Plain cotton goods.

5763. Was it heavily sized?—No, medium.

5764. Did it weave pretty well there?—In summer it wove all right; in winter it did not weave as well with being dry.

5765. Was that when they did a degging?—No, they did a degging in summer time, when it was drier still.

5766. How about your wages? Did you get as good wages in that dry shed?—We made better wages in summer time.

5767. But taking it all the year round?—It was too cold in winter time.

5768. Taking it all the year round, at which places did you make the best wages—the wet sheds or the dry sheds?—I am making the best wages now in a dry shed.

5769. Better than you did then. But then the wages have gone up since, have not they?—About 5 per cent. more.

5770. At this place you spoke of, the dry shed you told us of last, the wages have gone up?—I was not there then.

5771. At this last one you were talking of?——— shed—yes, they have gone up there.

5772. Have the wages gone up?—Yes. They are not as high now as they were then. It is not only the conditions they are working under.

5773. You are working now in whose place?———

5774. That is a dry shed?—Yes.

5775. Is it a comfortable shed to work in?—The steam pipes run through, and it is comfortable. When they put steam through it does not blow out; they do not let it evaporate in the room.

5776. It is just to warm it—just for warming purposes?—It is more comfortable working when there is a bit of steam going through than working without it.

5777. Do not they keep the steam going through?—No, they do not.

5778. That makes it uncomfortable?—Yes, very cold.

5779. But you said you were getting pretty good wages?—I am doing pretty fair there.

5780. Did you say you look after six looms?—I look after five just at present.

5781. Then that means that you have pretty good stuff to work on, I suppose?—Yes, the best stuff in there that we have had since I went there.

5782. As an old weaver, would you be in favour of the abolition of steam in all weaving sheds?—I should prefer a dry shed to a wet one with steam blowing out.

5783. But I suppose there are some classes of goods where it would be rather difficult to weave unless they had some steam sometimes?—Those are heavily-sized goods, I fancy.

5784. (*Mr. Hartley.*) You think you would prefer to work where there is no steaming, you say?—Yes, I would.

5785. Is that entirely because you feel discomfort where there is steam about you?—No. I think it is better for the majority at large, both for the weaving and all. If they will put good stuff in they do not need to put steam in to make them weave.

5786. But you have not felt any ill effects upon yourself in your health, have you?—I have never been in ill health since I went yon, and it is a dry shed.

5787. It is ventilated at present?—Yes, it is well ventilated, but it is cold.

5788. Do the fans run in the morning before it gets warm enough. There are fans in that shed. Are they running all the time?—Yes, they start with the engine; they have a strap off one pulley on to this ventilator. It is very cold till about 9 or 10 o'clock.

5789. How long have you worked at this place, do you say?—Fifteen months.

5790. Have the fans been in all the time?—No, they have been, as nearly as I can tell you, about eight or nine months. It was last summer when they put them in.

5791. Did you find any beneficial effect after they put them in?—No. I think it has been worse, both for weaving and colder.

5792. You think it makes them weave worse?—Yes, I think so.

5793. Why?—I cannot say why. It seems to be draughtier; it is colder.

5794. Before these fans were put in, did you never feel a close stuffy feeling in the place?—No.

5795. You never felt it moist—a kind of clammy feeling?—No, it was very dry before.

5796. What makes you think it weaves worse now with the fans in?—Well, it is colder. It weaves bad in summer time at yon firm I am at. That is the reason why I think it would weave better under the former conditions, as I have mentioned before—steam going through the pipes and not blowing out, with taps.

5797. You think it weaves worse when it is cold?—It does weave worse when it is cold. It is too cold in yon shed.

5798. Do they water the floor yonder?—No.

5799. Never?—Well, it is a bad shop for one thing, and whenever there is a downpour of rain there is generally some on the floor. It comes through.

5800. (*Mr. Cross.*) You worked at ——— mill you said?—Yes, it is a good while since, you know.

5801. How long since?—Fourteen years since.

5802. That is rather too far back. We will take then ——— mill?—Yes, that is three years since.

5803. What is your physical condition now as against the three years you had at ———'s in the way of eating and feeling fit generally for your work. You see what I mean?—Yes.

5804. How do you feel now in comparison with that three years' service at ——— mill?—I feel better now, a lot.

5805. Suppose it was a question of 24s. at ———'s and 23s. where you are, which would you take?—I should take 23s.

5806. You would take 23s. for a dry shed as against 24s. for a steaming shed?—Yes.

5807. And you attribute all this difference in the way of your feeling better and more physically capable to changing from ———'s kind of shed?—Yes. I would sooner be at ———'s, where I am now. I feel better in health.

5808. How long is it since you were at ———'s?—It is not three; it will be two last February. Two years and about three months happen.

The witness withdrew.

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Mrs. F—— N——, called and examined.

5809. (*Chairman.*) Are you a weaver?—Yes.
5810. Where do you work?———.
5811. How long have you worked there?—About ten months.
5812. Did you work as a weaver before?—Yes.
5813. Where did you work before?———.
5814. For how long?—Two years.
5815. And before that?———.
5816. And for how long before?—I could not say how long for.
5817. Nearly. You need not remember exactly. Would it be a few months?—It was about two years and a half.
5818. Was that the first place you worked at?—No, ———.
5819. (*Mr. Hartley.*) Those are all at ——— that we are talking of now?—Yes.
5820. (*Chairman.*) That is, all the places you worked at?——— was at ——— mill first; then I went to ——— shed.
5821. That is all?—Yes.
5822. That is a good many places you have been in?—Yes.
5823. Which was the most comfortable shed you worked in as far as your comfort is concerned? Where did you feel the most comfortable?—You mean the healthiest place?
5824. Yes?—I think the ——— shed where I worked at.
5825. Is that where you are working now?—No, ——— I work for now.
5826. Are they all places where there is no steam let in? You probably understand what I mean by that—they talk of dry sheds and wet sheds?—There is only the steam pipe run through.
5827. There is a steam pipe runs through to make it warmer?—Yes.
5828. Sometimes they have steam pipes to let the steam out to make the air moist; they say it weaves better?—Yes, but I have never seen that.
5829. Whose was the place which you said was the best for health?———.
5830. How was that shed ventilated?—I never took particular notice of the ventilation.
5831. Were there any fans?—No, there was not any fan like there is at ———.
5832. ———. That is where you are now?—Yes.
5833. About the fans where you are now. Do they make it more comfortable in the summer?—Well, I think, for my part, it makes it rather draughty.
5834. Do you feel the draught in summer?—Yes, as well as winter.
5835. And in winter?—Yes.
5836. Do you like the fans or do not you like the fans?—I do not care for them for my part. I do not like a draught.
5837. And you really think you do get a draught from them?—I feel it sometimes. I fancy it is the way the wind blows.
5838. You think sometimes you get it?—Yes.
5839. Not always?—I do not always feel it. I have had so many colds since I went yonder.
5840. Have you had any trouble about weaving in dry winds—when the wind is north or east?—It does not go as well at some times as at others.
5841. And what do you do then? I suppose the ends break a bit, do not they?—Yes.
5842. Do you water the floor?—No, we do not water the floor.
5843. Do you put any damp cloth upon the beam?—Sometimes we do, to make them do better.
5844. And you cannot tell us anything about what they call wet sheds. You have never worked in one?—No, I have not.
5845. But you get on very well where you are now without the steam?—Yes.
5846. And it is only on rare occasions you have to do just a bit of wetting the warp?—I have not to do any, not just now, but I have done.
5847. You have done it sometimes?—Yes.
5848. (*Mr. Thomas.*) How far do you work from one of these fans?—About four runs.
5849. In the other direction how far away from one do you work?—I could not say, I am sure, how many alleys it is.
5850. Do you think it is more than four?—Further down one way, but higher up it is not.
5851. One way it is not more than four, but it is more than four another way?—Yes.
5852. Do you work about half-way between the two fans?—I do not know just the distance. I have not noticed them particularly.
5853. You can measure it by the alleys. That is how you measure it?—Yes.
5854. You say you have had many colds since you went there?—Yes, I have.
5855. Do you put that down to these draughts or what?—I think it is the draughts, but I do not know.
5856. Have you more colds now than you used to have?—Yes, I have more colds now than I had then.
5857. There were no fans there?—No, I have never seen any, not like there is yonder.
5858. (*Mr. Hartley.*) How long have you worked at this place?—About ten months.
5859. Before that you were at the ——— shed?—Yes.
5860. Would you be there nearly two years ago—the summer before last?—I was at home about twelve months in between.
5861. So that you would not be working in a mill then in August two years ago—the summer before last?—Yes, I worked in one then. Two years ago I was working.
5862. It is not quite two years ago, twelve months last August I mean?—I think I was working then.
5863. You do not remember perhaps a very hot spell of weather?—Not last summer. It was not hot.
5864. No, the one before last.—Yes, I can remember that.
5865. You were working then, were you?—Yes.
5866. There is no ventilation in this place at all?—I have never noticed.
5867. The windows do not open, do they?—Yes, the windows are open, but any more ventilation I never noticed.
5868. You do not remember whether you were exhausted more than usual at this particular hot time?—I felt the heat more than at other times.
5869. Speaking about this draught that you feel, where does the draught seem to come from?—It seems to blow right in sometimes from somewhere. You can feel it as you are standing.
5870. But it does not come from the roof, from the fan?—It seems to come right down on to you. It is not only me that has remarked about it. There are others who have remarked about it.
5871. (*Chairman.*) We do not know whether it is the plenum or exhaust.—(*Mr. Hartley.*) It is the exhaust. It is running towards the fan, and that produces the draught. You have found it to vary partly according to the wind?—Yes, I think so.

Mrs. F — N —.

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5872. That is, if the wind is on the warehouse side, blowing into the shed, you feel it more then?—It seems to come this way on to me (*indicating*).

5873. That is from the north I expect. What do you think about the fans and the effect upon the weaving? Have you noticed any?—It makes it weave worse.

5874. Do you think those colds which you spoke of just now, which you get, are due to the room not being warm enough or to the draughts?—It is very cold in the morning, very cold. It is about 40° in a morning, I should say, or 47°.

5875. Have you a thermometer there?—Yes.

5876. You have looked at it?—Yes. On Tuesday morning it was 47° at six o'clock.

5877. Of course, the steam would be in the pipes?—Not so very much, if any.

5878. Speaking of draughts, do you think you feel the draughts more when the weather is very cold—when it is cold outside, I mean?—It seems to be worse in windy weather.

5879. In windy weather?—Yes, when it is very windy you can feel it.

5880. You have not noticed whether much dust rises towards the fans?—No, I have not noticed that.

5881. You have never looked at the fans, when they are stopped, to see if there is dust on them?—I have not noticed them particular.

5882. But you are certain it weaves worse when the fans are working?—Yes, I think so.

5883. (*Mr. Cross.*) What part of the day do you feel these draughts most?—I feel them all through the day.

5884. Are they as sensible to you, can you feel them just as strongly, in the afternoon as you can in the morning, say, when you start at 47° of temperature?—You feel it more in the winter.

5885. Up to what time about?—About dinner time.

5886. Then after?—Then it feels a bit warmer in the mill; you do not feel it as much, I think. It is very cold in the morning.

5887. These colds which you have had have been the result of the draughts. They get on to your shoulders?—It has just been a cold.

5888. A chill?—Yes.

5889. (*Professor Lorrain Smith.*) You do not have colds in summer time?—Well, very often I do have colds.

5890. Even in summer?—Yes.

5891. Are they worse or better than in winter?—I have had them worse lately since the cold weather has been on. I had not much when I worked in the other sheds.

5892. (*Mr. Hartley.*) You would rather have a shed which has not fans working in it?—For my own part I would. I liked — place.

The witness withdrew.

Mr. THOMAS NUTTER, called and examined.

5893. (*Chairman.*) What is your profession?—Manager.

5894. At what works?—Bankfield shed.

5895. How long have you been there?—Better than two years at yon place.

5896. For how long have you been associated with weaving factories?—All my life—above twenty years.

5897. In this district chiefly?—Yes, all the time.

5898. All the time in Barnoldswick?—Yes.

5899. Could you tell us what sheds you have had experience of there?—Yes, Clough Mill, Long Ing Shed, Calf Hall Shed, Bankfield.

5900. And are all of these what are known as dry sheds?—Yes.

5901. Have you had any experience of artificial humidity?—None whatever.

5902. Have you experienced any difficulty in weaving on account of dryness of the atmosphere?—No. They vary. At some times they do not weave as well as at other times.

5903. Taking one year with another has the inconvenience ever been found to be serious?—No.

5904. Have you ever had to do what is known as degging—watering the floor?—No, the most I have seen is these wet clouts.

5905. On the beams?—Yes.

5906. Sometimes they do that?—When they have had working—dry working.

5907. Taking the class of goods you weave in these mills, how would you describe them—high-class warps or inferior, or average, or what kind of material is it?—An average I should think.

5908. Working on that kind of material, are you of opinion that it can be carried on satisfactorily without the use of artificial humidity?—Yes, our class of goods.

5909. As regards the condition of the sheds, we will take a winter afternoon when the gas is burning and when probably there will not be much ventilation. I suppose in winter most of the ventilators will be shut up, will not they?—Sometimes when the weavers grumble we might close them. We have eight ventilators.

5910. In your present place?—Yes.

5911. What sort of ventilators are they?—Outwards. (*The witness explained.*)

5912. Exhaust fans?—Yes.

5913. Supposing they were stopped, would the room get foul more or less. Would the air begin to feel unpleasant and stuffy?—We just close one now and then if there have been several complaints about a draught. That is all.

5914. Then do you shut off one or shut them all?—No, we have never had them all shut off.

5915. Do you think that running them makes the air purer for the workers?—Yes.

5916. And more healthy?—Yes.

5917. In the other places where you have had experience were there any of these fans?—No.

5918. How do you compare the health conditions for the workers in the places where you have the fans and in the places where they have not?—I think we are much better now than we have been before.

5919. You think you are better?—Yes.

5920. Do you think the health of the workers is better?—Yes.

5921. In very hot summer weather, in places where there were no fans, did you ever have complaints of excessive heat or discomfort on account of heat?—Yes, we have had it these hot summers. We have had complaints then, but not down yonder.

5922. Comparing the places where you have had no fans with the present place, which is the most comfortable in the summer?—Certainly where we are now.

5923. There are some people who are very susceptible to draughts, and others do not feel them. Have you had many complaints about the draughts?—No, I do not remember any particularly.

5924. Do you go through the shed yourself pretty frequently?—Yes, once or twice every day.

5925. Have you experienced any feeling of draught from the fans when they are running?—No, I have not.

5926. (*Mr. Hartley.*) You say you have had very few complaints about draughts?—Very few.

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Mr. T. NUTTER.

5927. What experience have you had of these fans?—Just a little over two years.

5928. You put them in when the place was new?—Yes, two years last November.

5929. Have you formed any idea as to the effect that this ventilation has on the humidity in the shed, whether it dries it or not?—Yes, it would dry it.

5930. Comparing this place with the one you left, do you remember whether the weaving conditions there were as good or better than where you are now?—Where I was at before, you see, we had those windows. We opened the windows. The weavers were always complaining then. It was not particularly the weavers under the windows, but just away, who complained most about the windows.

5931. About the draught?—We have not had much since down yonder.

5932. That is on the question of draughts. I was asking you more particularly as to the effect of ventilation upon the air in the place, whether it made it drier or not?—Yes, I should think it would make it drier.

5933. Why have you bricked underneath your looms?—For the air to rise up—general dampness, moisture from the ground.

5934. Do not you supplement that at times by putting water in those bricks?—We have nothing to do with it ourselves. We have a water pipe running the length of the shed down the middle of the shed, and the weavers have it for use. We do not force anything. It is only just as they want it.

5935. In dry times they run water under the looms where these bricks are?—Yes.

5936. The object, as I take it, being to saturate the bricks with water?—That is so.

5937. That is, to get more humid conditions?—Yes.

5938. Do you find that that answers?—Yes.

5939. Speaking of the winter time, when you ventilate, you say you ventilate through the window?—Yes.

5940. Are you sure those fans are working in winter time?—Well, there is a lot of difference in the weavers. If one complains once or twice we go and close it up for them.

5941. We want to get at the facts. It is not a question of complaining whether you ventilate or not, but we want you to tell us whether the weavers stop those fans?—No, the weavers have nothing at all to do with them.

5942. But are they stopped?—No, they are not.

5943. Are you quite sure?—Yes. The first winter, I daresay, we had half of them stopped, but never since.

5944. And you say it was not the weavers who stopped them but yourselves?—The weavers complained.

5945. It was because of complaints by the weavers?—Yes.

5946. Suppose you were bringing air in instead of taking it out—you are taking it out now, for they

are all exhaust fans—what would the effect be then on the weavers. Would the draught be more likely to be felt?—Yes, I daresay it would.

5947. Do you remember the inspector taking tests in your place for air?—Yes, I do.

5948. Do you remember the date?—September, I think. I could not exactly say, but it was some time last year.

5949. Have you any means of finding out?—Yes.

5950. What part of the day was it?—It was in the afternoon.

5951. Before lighting-up time?—Yes, before lighting-up time.

5952. In September?—I believe it was.

5953. About that time?—Yes, I think it was.

5954. Did the inspector ever complain to you about the condition of the air?—He did.

5955. And the fans were working?—The fans were working.

5956. Did he tell you what he found?—No. He told us he had got a bad result.

5957. But he did not say how many parts there were of this CO₂?—No.

5958. He did not tell you that?—No.

5959. But you are quite clear that the fans were working when the tests were made?—Yes.

5960. Absolutely certain?—Most of them. I could not say for one or two. We have had one or two stopped in winter, but generally we have had most of them going.

5961. But it was before lighting up time?—Yes.

5962. You are sure it was in the afternoon?—Yes, in the afternoon.

5963. You have told us that you do not find humidity requisite for the class of goods you manufacture. Would you mind saying about the average counts that you use of twist?—They range from twenties to thirty-sixes. We never go beyond thirty-sixes.

5964. When you get thirty-sixes you get a very good quality of yarn, I presume?—Always the best that we can get.

5965. But generally you are below thirty-sixes in counts?—We range from twenties to thirty-sixes, chiefly on thirty-sixes.

5966. This is the warp. From twenties to thirty-sixes you say you use. And you also say you use coarse reeds mostly?—Very coarse reeds.

5967. I think you will admit that does not put your yarn to much of a test?—That is so.

5968. It does not test it?—That is so.

5969. There is no great test of the strength of it?—No, there is not.

5970. Yours is not an average place. It is better than the average?—It is.

5971. So you will admit it would not be any criterion of a fair average of the sheds in Lancashire?—I do not think it would. Honestly I do not.

The witness withdrew.

TWELFTH DAY.

Friday, July 24th, 1908.

At Manchester.

PRESENT:

SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.
 Mr. WILKINSON HARTLEY.
 Mr. H. HIGSON.
 Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.
 Professor JAMES LORRAIN SMITH.
 Mr. F. THOMAS.
 Mr. D. R. WILSON (*Secretary*).

Dr. JOHN CADMAN, called in and examined.

5971a. (*Chairman*.) You are a Doctor of Science?—That is so.

5972. And you are one of H.M. Inspectors of Mines?—Yes.

5973. You are engaged in special research work in connection with ventilation in mines for the Royal Commission on Mines now sitting?—That is so.

5974. You were Government Inspector of Mines in the Colonies of Trinidad and Tobago and have been recently appointed Professor of Mining in the University of Birmingham?—Yes.

5975. I think for a number of years you have made a special study of the effect of temperature upon workmen engaged in mines?—That is so.

5976. Also in the tropics?—Yes.

5977. As a result of your study, what conclusion do you come to in regard to the susceptibility to temperature of the workers?—The conclusions arrived at are that the personal effect depends upon the temperature registered by the wet bulb thermometer, no matter what the amount of humidity or the amount of vapour in the atmosphere.

5978. From that point of view it does not matter what the dry bulb registers?—That is so.

5979. You base your opinions, I take it, upon a somewhat lengthened series of experiments?—Yes.

5980. Both above ground?—Both above and below ground, but above ground in the tropics only.

5981. And you give in these tables,* I think, in detail, the results of your investigations?—That is so. I have selected a few which I thought rather had a bearing upon this particular point.

5982. I do not think it will be necessary to go into that now, because we can refer for the details to the evidence which will be published and has been read by this Committee. Have you any knowledge whatever of humidity in cotton cloth factories?—I am sorry I have not.

5983. You are not aware of the actual conditions prevailing there?—No.

5984. Perhaps you have not had an opportunity of studying them?—Not at all.

5985. The tables that you have been good enough to prepare make reference to the amount of clothing worn by the workers?—That is so.

5986. I think you point out that whether there is a current of air or otherwise will make a very considerable difference in the feelings of the worker?—A considerable difference.

5987. I think you have given us in the paper that you have prepared some idea of the velocity of the current that was passing at the time of the experiment?—I have not exactly given the velocity. For instance, take some of the 78 wet bulb temperatures

away from a current of air one feels very depressed; but on getting into a current of air there is enormous relief at once.

5988. Amongst the miners do they make a current of air a draught?—Yes, a current of air is made to circulate round the workings, but the velocity at which the current flows varies very much. At a certain point you may get a severe draught impinging upon the men; at others, although there is the same volume passing, there is no appreciable draught.

5989. The same volume, but at a different speed?—Yes, and, of course, that is one of the points about working in high temperatures in deep mines which the management keep very much in view, viz., as great a velocity as possible at the point where men are employed.

5990. Can you give us approximately some idea of the average velocity of the current in mine workings?—It varies from less than 100 feet per minute to about 400 feet per minute—that is actually at the working face. Of course, in the airways you get up to 1,000 feet per minute.

5991. What effect has the draught upon the miners?—If the temperature happens to be below 60 or 65° wet bulb they complain about it, and put on more clothing.

5992. They complain about the draught?—Yes, but if the temperature gets up to 70° and over 70° they are rather inclined to complain if they have not got it.

5993. Then the general conclusions that you arrive at: with 72° wet bulb inconvenience is experienced unless heavy clothing is removed and light clothing worn?—That is so. A point I would lay stress on is: that such conclusion has been drawn from the whole series of observations. The actual amount of clothing worn depends to a certain extent upon the severeness of the work. I have some photographs here which will perhaps illustrate this point. In this No. 1 you have 69° wet bulb and a man working with little clothing on. No. 2 70° wet bulb with a fairly stiff type of work.

5994. Actual coal getting?—Yes, actual coal getting. That No. 3 is a photograph taken by Mr. H. W. Hughes. The temperature here is 70° wet bulb. Mind you, this is the same dress that one gets at a higher wet bulb temperature with work which does not require so much exertion. The amount of energy put into the work by the miner governs to a certain extent the dress of the worker at those temperatures; but, taking them on the whole 72° is the temperature at which you yourself have got to strip, and at which you find the miners working with very light clothing. This photograph No. 4 shows a higher temperature where little inconvenience appears to be felt if bare body surface is exposed.

5995. At 78°?—At 78°.

5996. But then does not that depend upon whether there is a perceptible current?—Yes; hard work is

* Appendix VIII.

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Dr. J. CADMAN.

greatly facilitated if a perceptible current is passing over the body.

5997. What conclusion do you arrive at assuming there were not a perceptible current, because that would be more the condition we should expect to find in a cotton cloth factory?—I should say 75° would be about the limit at which reasonable work could be done providing clothing was worn. That is wet bulb temperature.

5998. And without a perceptible current?—And without a perceptible current. To return to 78° wet bulb, take a case of no current and no clothing, you could do very light work, but only light work. Introduce now a perceptible current playing on the body at that temperature, and reasonable work is possible.

5999. I think you told us before that you have not a knowledge of cotton cloth factories, but I think we may say that anything like a perceptible current is not to be found in those places. Of course, there is ventilation, but I do not think it would be a perceptible current.

(Mr. Roberts.) Weavers complain if they have a perceptible current.

6000. (Chairman.) Then at 82° wet bulb what do you say?—At 82° work of any kind appears to be impossible unless you have a perceptible current passing over the body. If I may enlarge upon that, I have seen cases with temperatures of 80°, 81°, and 82°, where one's own body temperature begins to rise, on slight exertion.

6001. That is very important. Can you tell us anything about when the body temperature begins to rise?—In my own case it has commenced in places at 78° with a fair amount of exertion. I have noted some cases, No. 20-21; but these were with considerable exertion.

6002. At that temperature you find that the body temperature rises?—It began to rise.

6003. Did it rise much above the normal?—100·1 and 101·1. But in the case of a man who was accustomed to the conditions it did not seem to rise quite so high. In the case of No. 21 it rose to 99·6.

6004. What conclusion do you arrive at with the wet bulb at 85°?—At 85° the body temperature invariably becomes affected. I have never myself been into a temperature of 85° and done ordinary work, a small amount of exercise, without my body temperature rising.

6005. Then at 93° wet bulb?—At 93° one is in a terrible state.

6006. You think work impossible, I think you have said?—I am sure that real work is impossible. There is work going on at the present time in some Cornish mines at 93°, but the amount done is very very little.

6007. (Professor Lorrain Smith.) How long can they stand that temperature, even doing a little work?—The miners' hours are about seven or eight, but I have never seen them actually do work. They do work, because there is evidence of it having been done; but frequently there are rock drills which are worked from time to time, and when the drills are working the temperature becomes much reduced.

6008. (Chairman.) Have you given your attention to the question of ventilation as measured by the CO₂ test?—Yes, I have some figures here which perhaps may be useful. I have here a series of observations which were taken from a number of collieries in different parts of the country. I should like to revise the reference numbers if you propose to publish them, because they refer to my plans.

6009. We do propose to publish them.—Then I will revise the reference numbers if I may. In the first column I put the CO₂ per 10,000; then in the next column the number of persons and animals that the air has passed over, and then the volume of air measured at that particular point.

6010. At the point at which the air was collected?—Yes, where the samples were taken. These figures are from a series of observations, and represent an average analysis at a spot where men are actually employed. Shall I read over the parts per 10,000?

6011. Please do so. Each record represents a different mine, and at an average working face at the far end of each mine.

No.	No.
1 - - - 32	20 - - - 14
2 - - - 149	21 - - - 142
3 - - - 11	22 - - - 27
4A - - - 52	23 - - - 12
4B - - - 30	24 - - - 19
4C - - - 47	25 - - - 42
4D - - - 34	26 - - - 17
5 - - - 10	27 - - - 21
6 - - - 44	28 - - - 26
7 - - - 85	29 - - - 28
8 - - - 7	31 - - - 119
9 - - - 58	33 - - - 31
10 - - - 95	34 - - - 42
11 - - - 93	35 - - - 35
12A - - - 13	37 - - - 35
12B - - - 15	39 - - - 20
13 - - - 16	40 - - - 55
14 - - - 60	41 - - - 10
15 - - - 22	
17 - - - 54	
18 - - - 159	

That gives an average of 45 parts per 10,000. Excluding four samples that are over 100, that brings an average of 35 per 10,000, which I put down as about a normal condition at the working face of the mines visited.

6012. Of course there are very great variations here varying as we see from 7 to 149; how is that accounted for?—That is accounted for entirely by the nature of the mine. CO₂ in mines really represents the factor of oxidation. The amount of CO₂ produced by the persons breathing is so infinitesimal when considered with the total volume of air that it really does not come into the figures at all. Take any of these analyses, whether you take the sample with men working or without men working, the analysis would be the same.

6013. Then I take it when you see such reading as 149 and 95 and 159 known mechanical appliances will not reduce it?—I would not say that. Where it gets to such high figures as those there is a defect. Take an average of 35, as being more to the point.

6014. That might be taken as a normal condition in mines?—A normal condition might be just a little bit below that. These figures are taken from mines where there are considerable difficulties.

6015. No doubt in your official duties you have considered that question as to this high amount of CO₂, and probably you have consulted with medical men and others as to the effect upon health?—Yes, but I do not call it high.

6016. When I say high, I am comparing it with the standard we have for cotton cloth factories, which, as you know, is nine parts in 10,000. But 35 you do not consider high?—No, I do not.

6017. Have you considered it from a health point of view in conjunction with medical men or experts of any sort on that point?—Yes, I have. Many of these cases I have been through with Dr. Haldane. I have worked in them myself. I have known miners that have been at it for years with an amount of CO₂ up to 35 and 40 parts per 10,000, and really they thrive very well, and there is no appreciable failing. It does not seem to affect you. I do not think you could realise that you were in it. As a matter of fact, at the present moment I am making observations for the Royal Commission on Mines with a view to suggesting a standard of ventilation for mines. Without going into details, I am suggesting that the limit be 100 parts per 10,000, that is 1 per cent.

(Mr. Roberts.) I was going to ask Dr. Cadman when he had finished if there was anything of the sort going on.

6017a. You are suggesting, doctor, that the standard for ventilation in mines shall be 100 parts in 10,000?—Yes, that is 1 per cent. CO₂.

6017b. We have a standard of 9 per 10,000?—Which is .09 per cent.

(Chairman.) You have not that delightful current of fresh air going through all the time.

Dr. J. CADMAN.

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(*Mr. Roberts.*) We have a great deal more area. We have a larger area of buildings, higher roofs, and that sort of thing.

(*Witness.*) In the figures which I have put in the current is passing through the whole area; if you take your sample in the top or in the bottom it will be the same.

6018. (*Professor Lorrain Smith.*) Just following up this point that you do not attach great importance to moderate quantities of CO_2 in the atmosphere, I suppose you do consider that the vital point is the humidity?—Exactly.

6019. That is as far as the health of the workers is concerned?—Yes.

6020. Have you any evidence that working in a humid atmosphere has an effect upon the health?—The only evidence that one has is that when the temperature gets over 78° or 80° you get serious complaints from the men; and it is usually found where you have got some defect in ventilation which, as a rule, can be remedied by better coursing.

6021. The point upon which we are wanting evidence is somewhat short of the outside temperature which sends up the body temperature. You say your temperature rises at 78° if working?—Yes.

6022. Say short of that, between 70° and 78° , can you give us any information?—I can only give you my own opinion. I think the temperature of 75° wet bulb is a reasonable limit. If you have very light clothing on, you could do work of a reasonable nature, but you could not continue to do work for any length of time with clothing on at a temperature over 75° wet bulb.

6023. There was another very interesting point which perhaps you would tell us a little more about. You gave us a temperature at which miners complain of the current?—Yes.

6024. You gave it at 65° ; is that pretty sharp?—It varies so enormously that it is rather difficult to give a definite temperature, because it depends entirely upon the velocity of the draught. A draught of, say, 250 linear feet per minute, at a temperature of 65° wet bulb, would be fairly chilly if a man were perspiring freely.

6025. Then you said that at about 70° the men would ask you to put it on if it were not there?—When the wet bulb gets over 70° it is generally recognised that it is desirable to introduce as much velocity as possible.

6026. In other words, what is unpopular with the men is a draught or chilling current of air?—Yes.

6027. You could not get that over 70° ?—I do not think you could.

6028. So it is a matter of 5° between a draught and no draught?—I am perhaps getting rather astray there. I would not say it is a matter of 5° . It depends entirely upon the velocity.

6029. What I was wanting to make out was this: at 70° it did not matter about the velocity?—Yes.

6030. That was rather a figure I was wanting to get from someone who has had experience such as yours. We have been considering the point with regard to complaints of the weavers as to ventilation giving them draughts. What I was desirous to get at was whether one could find any definite temperature when draught does not exist?— 70° I should say. At 70° no inconvenience would be felt from a draught at any velocity.

6031. And nobody would complain?—That is so.

6032. It is fairly sharp. There is only a difference of 5° in the temperature between a moderate current being a chilly draught and not a chilly draught; if you go up 5° you can put on any current you like?—I should certainly put it down that at 70° no current has any effect from the point of view of draught and chilling effect. 65° is a very elastic point, because it depends entirely upon the velocity.

6033. We are told by the manufacturers what is the ideal temperature for weaving cotton at; it is about 70° , or a degree or two above or below; but it is important for us to know that if you keep to that you need not have any complaints of the workers about the velocity of the current.

(*Mr. Roberts.*) That refers to wet bulb temperature.

6034. (*Mr. Shackleton.*) The only question I want to ask is this. When you say 75° is the limit, you mean it should not exceed that?—I am sorry; I do not follow you.

6035. Seventy-five degrees is the wet bulb limit—I understand you to mean that it should not exceed that?—Yes; that is providing you are clothed.

6036. Take me as I am now, but with my jacket off?—At 75° you would be perspiring pretty freely if you were working fairly hard.

6037. I have here a number of cases which I will just read out to you. We have one case at 84° wet bulb, four at 83° , three at 82° , six at 81° , two at 80° , one at 79° , four at 78° , and two at 77° ; all these were actually registered on the 2nd of this month. There is not one of those that comes within your 75° limit?—What type of work were they doing?

6038. Weaving, dressed as I am now, with jacket off and scarf off and sleeves rolled up?—What is the nature of the work—is it like loading?

6039. No; walking about, turning machinery round and setting it on?—I should say at that temperature the workers would be getting pretty pulpy, and not doing anything like efficient work.

(*Mr. Shackleton.*) Mr. Chairman, would not it be advisable to get Dr. Cadman to stay in one of these sheds one hot afternoon, so as to get familiar with the laborious character of the work?

(*Chairman.*) With Dr. Cadman's love of scientific research, I think perhaps he might like it.

(*Witness.*) I should like to very much, indeed.

6040. (*Chairman.*) Perhaps you would accompany us one day?—I am afraid I am rather pressed for time at the present moment, because I am going abroad on the 4th of next month, and I shall be away a couple of months. If of any use to you, I might then be able to go with you.

6041. (*Professor Lorrain Smith.*) You could not spare a day, say, the week after next? Mr. Wilson and I would go with you.—May I talk it over and see if I can arrange it? I am extremely engaged just now. I should like to see the conditions very much indeed. It is a particularly interesting point to see the condition of the temperature you are referring to.

6042. (*Mr. Shackleton.*) Take yesterday; the last figures we have (wet bulb) are 74.5° , 75° , 75° , 75.5° , 74.5° . Yesterday was only an ordinary day, not a very hot day at all; so you see your limit is going to cover a tremendous number of days in each summer.

(*Mr. Roberts.*) If we were limited to that, many sheds would have to stop 50 days in the summer.

(*Mr. Shackleton.*) That is what I wanted to get at.

(*Mr. Roberts.*) That is so. So that I think, Mr. Chairman, the suggestion is a very good one that Dr. Cadman should see into several of these mills so as to get a good idea, at any rate, of the style of work.

(*Witness.*) Of course, in saying 75° I am assuming that one is fairly well clothed.

6043. (*Chairman.*) You will understand that in these weaving sheds the majority of the workers are women; consequently people must be clothed. It is not like a mine where a man can strip to the waist.—I am absolutely confident on the point of 75° wet bulb being a temperature at which a person with any reasonable exertion and clothed would perspire very freely.

(*Mr. Shackleton.*) The temperature at one mill yesterday was 76° and 77° .

(*Mr. Roberts.*) I should be very pleased to talk to Dr. Cadman after he has seen these sheds.

(*Witness.*) I should like to see them very much.

(*Mr. Hartley.*) Can Dr. Cadman come and give evidence again?

(*Chairman.*) If he has an opportunity of seeing the sheds and would give us the benefit of his views, then I think we should be very much obliged to him.

6044. (*Mr. Hartley.*) At present this evidence of Dr. Cadman only goes to show that discomfort to the worker begins at 75° wet bulb, not actual injury to health.

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Dr. J. CADMAN.

(*Witness.*) I do not speak to actual injury to health. That is a point I cannot really speak upon.

6045. The body temperature begins to rise at what wet bulb temperature?—It rises at about 85°.

6046. With work?—Under certain conditions at 78° to 80°.

6047. Are those tests from yourself or from the workers?—From myself, as a rule.

6048. You did not test to see whether it had this injurious effect upon those actually engaged in work?—Yes, I have done. At 78°, where my own temperature has gone up, people working in the condition continually it did not seem to affect.

6049. There was no rise in actual body temperature of the workers?—I have two cases at 78° where considerable exertion put my own body temperature up, but the temperature of the men actually working under those conditions was normal, that is to say, the mouth temperature. In one case, where the manager was with me and who was continually going through it, I think at 78° his temperature went up a little bit; it went to 99.6.

6050. (*Mr. Hartley.*) Is it your opinion that the workmen under these conditions can become acclimatised?—I think you can become acclimatised to a certain extent. One sees that in the tropics. When you go out, in the early part of your time you experience a considerable depression from the heat, but after a few months there it does not affect you so readily. I think that is fairly well established.

6051. You were speaking just now about a current of air and the temperature of that air and the point when draught would be experienced. You gave us 70° as a temperature at which draught would not be felt. Did you mean that the air coming in should be at a temperature of 70°?—Yes.

6052. Not the room itself?—No, I am speaking of the current of air that is passing at that temperature.

6053. The moving air, the air that is being brought in; the current of air should be at a temperature of 70°?—Yes.

6054. If the inside temperature, if I may put it in that way, were at 80° or 85°, you say the operative or the miner would not feel any draught?—That condition is rather different.

(*Mr. Hartley.*) This is practically the point. You have sheds at a temperature of 85° to 90°. You are bringing in from outside air at 70°.

(*Professor Lorrain Smith.*) Do you mean 85° to 90° wet bulb? You must put them all on the same basis.

6055. (*Mr. Hartley.*) I will change the form of the question. At a temperature of 70°, no matter whether wet bulb or dry bulb, with 85° inside and 70° outside, do you say that the workers would not experience any draught?—I do not follow how you could have 85° inside and 70° draught.

6056. Oh, yes?—I am speaking of the current of air which passes through if you take the 75° on this side, then on this it would be 75°.

6057. You must limit your answer to mines?—I do; I have no experience at all of factories. I must admit that.

6058. We do get such a condition of things as a difference of between 15° and 20° between outside air and inside air. Notwithstanding that difference, would the worker experience a draught if the incoming air were at 70°?—If the temperature of the place itself, say, stood at 80° wet bulb.

6059. It does not matter whether wet or dry for my purpose?—It makes all the difference.

6060. Call them both dry, both inside and out?—Call them saturated. If you impinge a blast of air on to we will say, a person who is in a room at that temperature, 80° wet bulb, he would appreciate the immediate change, but at 70° wet bulb he would not experience any inconvenience. I do not, I am afraid, understand the point quite clearly.

6061. (*Mr. Cross.*) I understand Mr. Hartley's question very well. If I am working at a temperature of 80° or 85°, and you bring in air at 70°, is there any draught to me as a weaver—can I, as a workman or

weaver, feel it?—I am afraid that is a point which perhaps I have not fully considered. My observations are entirely in a current of air at that particular temperature.

(*Chairman.*) I should be rather disposed to think that the question of importance is not whether you feel it, but whether you feel it in such a way as to cause you discomfort or injury to your health.

(*Mr. Hartley.*) Quite so.

(*Chairman.*) The point is that a current of air in hot climates may be extremely agreeable; for instance, to work mechanical fans to send the current on to us. The question really is the temperature of the draught.

(*Mr. Cross.*) As a weaver, I complain of a chill. That is what I mean when I say a draught.

(*Chairman.*) Not at 70°.

(*Mr. Cross.*) I want to know.

6062. (*Professor Lorrain Smith.*) I understand Dr. Cadman's reply to be this: that any individual, standing in a current of air at 70° does not feel a draught however quickly it is going, and it does not matter what the temperature of the shed is. A man complains of a draught because he is standing in a current of air which is cold, but he will not feel a draught if the current of air is at 70°.

(*Witness.*) He feels a draught which is pleasant.

(*Chairman.*) It is a draught whether it is hot or whether it is cold; but the difference is whether it is an unpleasant draught or a draught that is likely to do injury.

(*Mr. Cross.*) I understand the witness to say that we shall not be chilled with a draught at 70°.

(*Mr. Hartley.*) I want to know whether they would suffer any injury to health by reason of a current of air passing, heated up to 70°.

(*Chairman.*) That is the point.

6063. (*Mr. Hartley.*) That is the only point I want to make. If we say to our operatives, "Air coming in at 70° cannot injure you," will that be right?—From my experience I do not think it can injure them.

6064. The condition existing in a mine and those existing in a weaving shed are entirely different, and it would be useful, I have no doubt, to you to see a shed?—Quite so.

6065. (*Mr. Thomas.*) I may put the point this way. Moving air at 70° and over, wet bulb, does not create discomfort?—That is probably the better way to put it.

6066. But in the event of a person working in a wet bulb temperature of 80°, and then moving air were brought in at 70° wet bulb, he would feel it for the moment until you got cleared away the air at 80°?—I should say it would be delightful. At 80° wet bulb you would be perspiring very freely and feeling generally depressed, and would welcome a draught of 70°, which, in my opinion, could not give you a chill.

6067. (*Mr. Shackleton.*) I should like to press that you should see, if possible in the afternoon, one of our mills?—I shall do my utmost to do so; I shall be only too glad.

6068. The day before yesterday we had one mill where it was registering 78° wet bulb, and that was an ordinary day. May I ask what was the condition of the people there: were they perspiring very freely?—Yes, and we were too.

(*Mr. Roberts.*) We were perspiring a great deal more than they were, that is to say, in sheds that I was in on Wednesday.

(*Mr. Roberts.*) Shall we get the benefit of Mr. Cadman's further knowledge when he has been through?

(*Chairman.*) I hope so.

6069. (*Professor Lorrain Smith.*) You have not said anything about your observations?—I have added to the list just a few temperatures in the tropics which show wet bulb conditions which begin to depress one very much. For instance, at 80° my own feeling was very depressed, no inclination to exert myself, and everyone seemed very disinclined to work. When it got to 83° wet bulb the observation is "very depressed and unable to exert myself to any degree." Then the next is interesting because it bears out the point I was putting. "On creating a breeze one felt refreshed." Then at 76° one sees this: sitting in the shade, perspired freely; one felt no discomfort. That rather bears out the point we have been discussing.

The witness withdrew.

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Mrs. A—— T——, called in and examined.

6070. (*Chairman.*) You are a weaver, I think?—Yes.

6071. Have you been a weaver for many years?—Yes.

6072. (*Mr. Shackleton.*) Where do you work at?—6073. (*Chairman.*) How many years have you been a weaver?—Since I was a little girl about twelve years old.

6074. Long enough, at any rate, to have a long experience?—Yes.

6075. Have you worked both in dry sheds and steaming sheds?—They have all been steaming sheds that I have worked in.

6076. Have you considered the question as to whether the steaming causes you any discomfort or in any way affects your health?—Yes.

6077. What conclusion have you arrived at—what do you say about steaming?—I think it causes a great deal of pains in the head. I know I have suffered a great deal with it through the steam being so hot.

6078. It affects your health?—Yes.

6079. And the particular form in which it affects your health you say is headache?—Yes.

6080. Is there any other discomfort from it?—Great heat.

6081. This summer we have had some very hot days?—Yes, we have.

6082. On those hot days what were your feelings when you were at work?—It has been bad to bear.

6083. Did it make you feel very tired, more than on other days?—Yes.

6084. Or could you get on just the same?—I have felt that I could not really knock about at all when I have got home, I have been that tired and wearied with it being so hot.

6085. The work was more distressing than on other days?—Yes.

6086. I am now talking, of course, of these exceedingly hot days. Take the average summer right through, do you find the work tell upon you more than in the cool weather?—Yes.

6087. It is more oppressive?—Yes.

6088. I suppose you are not able to say what the effect upon weaving would be if you had no steam?—If we had not steam, then really in coarse stuffs we could not do at all, it would be impossible, I am sure.

6089. It would be impossible to weave?—To weave; the stuff is so bad it really will not do without the steam; it seems to go stiff and to crack in the hot weather.

6090. You think for the class of work that you are engaged upon that steam is necessary?—It is necessary for the stuff that we should go on with it; we could not do without it; if we had not steam, it would not weave.

6091. That is the stuff you work on you mean?—Yes.

6092. You say you want steam; have you considered how much steam you want? I mean by that, do you sometimes get more than is necessary for the work?—Sometimes we have more, and sometimes the weavers have cause to turn it on.

6093. That is when you have not enough for weaving purposes?—Yes.

6094. (*Mr. Higson.*) You do not think you could weave without steam, you say?—No.

6095. What about the steaming in cold weather: do you sometimes feel your clothes wet, or is there anything of that sort takes place?—You might do with less steam in cold weather than you do in summer time.

6096. You have cloakrooms at this mill?—Yes.

6097. Every weaver puts her clothes in the cloakroom?—Yes.

6098. So you do not suffer anything of that sort?—No.

6099. (*Mr. Cross.*) Where is the place where the weavers are allowed to turn on the steam themselves?—

6100. Do the weavers turn on the steam there when they want it?—Sometimes they do; I have seen them.

6101. Then it is not governed by the overlooker or the manager?—I cannot tell you about that. I have seen them turn it on and off.

6102. Have you known any cases where the weavers have objected to turning it on close about where you work?—No, I do not remember. I know some of the weavers have complained of it being turned on, and some have turned it off, and it has been a cause of dispute.

6103. How long have you been at ——?—About two years, or rather over two years.

6104. What was the last steaming shed you were at before that?—It was —— or the ——; I just forget. I know I was at the place when you were there.

6105. Which —— do you mean?——, near the police station.

6106. There is a great difference between that and the —— You have worked in the —— shed?—Yes.

6107. What was the work in the —— compared with that in the shed you work in now; which would you prefer of the two; would you rather have the —— weaving shed or —— shed?—We had all sorts at the —— shed; there were two or three sorts.

6108. They are both steaming sheds. Which do you prefer, where you are now at, —— mill or the other—the ——?—Sometimes you are encouraged with a bit more money at —— Of course there is a difference in the width of the looms.

6109. (*Mr. Hartley.*) Yourself, do you really think that the steaming injures the health of the weavers?—Yes, I do.

6110. In what way?—In the head; I suffer a deal in the head.

6111. You, personally; but taking the weavers as a whole class, do you think they suffer from steaming?—Yes, sometimes it comes too much, and really their clothes get wet and damp with it.

6112. Have you seen that yourself?—Yes, I have; and it causes you to sweat a great deal, and your clothes are completely wet through when you go home; I know mine are.

6113. From what particular mill?—That one I am working at now.

6114. (*Mr. Cross.*) That applies now?—Yes.6115. (*Mr. Hartley.*) You have had your clothes wet through with steam?—No, sweating through the steam.

6116. I am speaking of getting wet by the steam. Have you noticed that your clothes get wet with the steam?—I could not tell.

6117. (*Mr. Cross.*) Has the top of your blouse been damp?—A little chillified, you know.6118-19. (*Mr. Thomas.*) Which shed do you work in at ——; do you know the letter?—It is not the top shed, it is by the side of the top shed. I know Mr. Cross was in it when he came through with several more gentlemen.6120. (*Mr. Cross.*) Which way do you turn to it when you go in at the watch-house?—It is next to the top shed, and you turn to your right when you go in at the watch-house.6121. (*Mr. Thomas.*) You have one of those instruments where there is a great big thing on the top?—Yes, I work close to it.

6122. Did you feel comfortable on Wednesday or otherwise when we were in?—It was awful on Wednesday.

(*Mr. Shackleton.*) It was 85° and 79° in one shed. The lowest was 77° wet bulb of the two sheds we went in.

The witness withdrew.

24 July 1908.

Mr. S— T—, called in and examined.

6123. (*Chairman.*) Are you a weaver?—Yes.

6124. How long have you been a weaver?—Thirty-eight or thirty-nine years.

6125. Have you worked in steaming sheds and dry sheds both?—I have worked mostly where I am now, at —.

6126. You have had steam there all the time you have worked there?—Yes.

6127. You know, of course, there has been a good deal of talk about steaming in sheds?—Yes.

6128. Some people say they like it; some say they do not like it; what is your opinion?—I do not like it. That is my opinion.

6129. Why do not you like it?—I think it is injurious.

6130. Injurious what to?—To health, I should say.

6131. How does it affect health?—I think when you come out of a mill when you are sweating you get cold and such like from being in such a heat.

6132. Then do you think that you feel the heat more where there is steam than where there is not steam?—I think so.

6133. From a manufacturing point of view do you think that it is necessary for efficient weaving?—I think they could do without it if they put better stuff in. They make it for steaming. They make it so that it will not weave without it.

6134. You mean that where a high-class yarn is used you might do away with steaming?—I should say so altogether.

6135. But would the use of high-class yarn bring up the cost of production—would the cloth cost more? I mean if there is a demand for that class of cloth somebody must make it. There must be a demand for it or it would not be sold?—Yes.

6136. If we did not make it who would make it—would it go to Bombay, for instance? (No answer.)

6137. However, you think the class of yarn that is used makes steaming necessary?—I do not think they need so much steam where there is a better class of yarn.

6138. I am speaking of the class of yarn that you are using?—I think they could do without steam if they put better stuff in.

6139. I am not talking about that: without putting better stuff in, as it is now, what do you say?—We could not get along so well. That is the top and bottom of it so far as weaving goes.

6140. I am assuming that a certain amount of steam is necessary. From your experience as a weaver do you ever find that there is too much put in?—Yes, I should say so, in weather like this particularly.

6141. At — who regulates it?—The manager reckons to look at it as far as I know.

6142. Do the weavers themselves ever turn the steam on and turn it off?—That is a common thing. Some will turn it on and some will put it off. If it is doing bad some will put it on, and then somebody will turn it off. That is the way they are.

6143. That is the workers themselves?—Yes.

6144. Have you suffered at all yourself on account of it?—I do not know about suffering.

6145. We have had some very hot days this summer. What were your feelings then?—I felt regular mashed up especially when going home at night; completely done up.

6146. That is on the hot days?—Yes.

6147. How do you feel on the ordinary days?—A bit better when it is colder weather, of course.

6148. You do not feel so exhausted or tired?—No.

6149. (*Professor Lorrain Smith.*) If the shed were kept cooler it would not matter?—I am certain we should be better if it were kept cooler.

6150. (*Mr. Shackleton.*) Have they Hart's system where you work?—That is humidifying. When the

shed gets too wet they put the cold draught on. I never need to look up at that fan. I can feel it. When I am sweating it is like chucking cold water down your back. That is when the glass is getting wrong, when it is getting too damp. I work by the side of the fan myself. You can feel the draught. I do not know whether they can remedy that thing or not, but you feel it when you are working and sweating at 90°.

6151. They are probably bringing air in at below 65° then?—It is when the glass has gone wrong, when it gets too damp.

6152. (*Mr. Higson.*) You feel mashed up, that is in the very hot weather?—Yes.

6153. How many days in the year have you that feeling, do you think?—I know this last two or three weeks I have felt that road.

6154. Everybody who is working under cover either in mills or as a moulder or a joiner or anything inside feels mashed up?—They are hardly as closed in as we are. They are bound to be worse in summer time.

6155. There is another thing you suggest, that it would perhaps be a remedy for the inconvenience of steaming if better stuff were put in?—That is so.

6156. You know that is a very common statement on the part of weavers?—Yes.

6157. Do you know anything about what better stuff means; could you get better stuff for the same money?—I believe in different parts of Lancashire they are without steam, and they must have better stuff.

6158. There is no part of Lancashire where they are weaving your stuff without steam?—No.

6159. We have discovered something that you may probably learn later on: that there is as much softness in sheds where there is no ventilation as you have in yours, or at least approaching it. You will perhaps learn something about that. How much more would it cost to put better stuff in to do without steam, do you say?—Of course, I do not know.

6160. You do not know a place that is making shirtings and making heavy sizing where there is no steam used?—In my time of weaving they had no steaming with some sorts of goods.

6161. At —?—Yes, and with the same sort of goods, and it used to weave well then. Of course, they were not making quite as much money at that time, but I think it was better for the weaver.

6162. Better for the weaver?—Yes.

6163. (*Mr. Hartley.*) How long since is that?—Thirty years since. I have been weaving 38 or 39 years. It was before the first strike that we had not so much steam. They used to have big round pipes in to warm the shed and steam running through.

6164. Do you think that there would be any complaint about steaming if it were always cool weather?—Well, of course you would not feel the effect of it the same.

6165. Does not the complaint about steaming come when it is very hot?—It makes you warmer.

6166. Cannot you answer the question? Do not you think that the prejudice against steaming amongst weavers is because of making it hot, is that it?—Of course, I think it ought to be done away with altogether. That is what I think about it.

6167. (*Mr. Cross.*) The point of the question is this: is it in summer time or in winter time that you feel the steaming worse?—We feel it worse in summer. It is as I say: they make it that it will not go without steam. In winter time some people wants it to make it weave better.

6168. Is there more steam used in your place to-day than there was within ten years?—No, not as much. There has not been as much used till you got yon humidifiers.

6169. Is it more troublesome to you with those humidifiers than it was before?—Not so far as the heat goes, but there is more discomfort to me because of the draught. The people at the other end of the shop do

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not feel the effect of these fans or humidifiers, but I have never been free from a cold for months, speaking honestly, and it is all through yon fans.

6170. The steam is shut off?—It is never shut off altogether. They can turn it off at the top.

6171. You said you could tell when that fan was in operation because of the draught or the chilling effect?—Yes.

6172. Is all steam stopped from being infused into the shed when that fan is going?—No, it is not. It is very rare that the steam is knocked off where there are humidifiers.

6173. Is there any case in any of the sheds of Hornby's where any ailment is attributed to steaming?—There is a lot that have had to go off through these things.

6174. (*Mr. Hartley.*) That is draughts again?—Yes, through these draughts.

6175. (*Mr. Cross.*) Are there any cases of rheumatism that you know of through the steam at Hornby's?—I have heard them say so.

6176. You do not know of any?—No, not properly. They have not the humidifiers at the other end the same as they have at our end.

6177. There has been no case that you know of through it?—No.

6178. Is it every summer alike with you that complaints are made about the oppressive feeling at work?—Yes.

6179. In what month do you generally start feeling it, and when is it most troublesome?—It starts in June. The last fortnight of hot weather we had was the time we felt it, or about a month sin'.

6180. What is the general effect on your appetite of those hot days?—I am not in such good form for eating.

6181. (*Mr. Higson.*) Do I understand you to say that you would rather be without humidifiers?—I would rather if they could arrange without yon draughts that they put on sometimes for about half-an-hour; that is when the floor gets dry and the glass gets wrong; it gets too damp, and they put those on. As far as weaving goes it will not weave at all; it is the same as having fresh beams in.

6182. They keep blowing steam in through the jets?—Yes. It is just the same as you having fresh beams.

6183. (*Professor Lorrain Smith.*) Do you find the shed warm in the morning when you go at six o'clock?—Yes, it is very warm then. It has not had time to get cool or something. It is warm enough then to work in.

6184. (*Mr. Cross.*) What part of the day troubles you most in summer time?—About half-past three in the afternoon and eleven o'clock in the forenoon is very bad.

The witness withdrew.

Mr. J— M—, called in and examined.

6185. (*Chairman.*) Are you a weaver?—Yes.

6186. How long have you been a weaver?—Ever since I was ten years of age.

6187. How old are you now?—Thirty-five.

6188. You have been a weaver 25 years then?—Yes.

6189. Where have you worked in that time?—The biggest part of my time I have worked at ———

6190. (*Mr. Shackleton.*) Are you at ——— now?—Yes.

6191. (*Chairman.*) That is a steaming shed?—Yes.

6192. You know, of course, as everybody in Lancashire knows, that there has been a great deal of discussion about steaming in sheds. Have you thought about it at all?—I think as we could do without it; we should be better, really.

6193. You think you could do without it?—Yes.

6194. Is there any necessity to do without it?—I think it is an injury to our health.

6195. In what way does it affect the health of the workers?—Many a time there is some of them faints through the heat, and with steam being in.

6196. The heat and the steam?—Yes.

6197. Do you think they would faint if there was no steam?—It was a lot cooler the other day without any. They tried it the other day without steam.

6198. How did they try it?—They kept it out.

6199. (*Mr. Shackleton.*) How long is that since?—The day before you came.

6200. (*Chairman.*) They kept the steam off all day?—Yes, it was quite cool.

6201. (*Mr. Higson.*) How did it weave?—That is another thing when you ask that question how did it weave. It weaves awful when the steam is out. No material will weave without steam.

6202. (*Chairman.*) The material you weave will not weave without steam?—No.

6203. You suggested that there should be no steam?—Yes.

6204. Now you tell us that you cannot weave without steam?—Not yon material. It might do if they brought better material in.

6205. Who is going to manufacture that material that you are working on now? Where is that going?—The masters should do it.

6206. The masters cannot manufacture it. You tell us first that there should be no steam?—Yes.

6207. Then you tell us that with the class of goods you are working on they cannot weave without it?—No, it will not weave.

6208. Do you say that the class of goods you are working on shall not be made at all in Lancashire?—It is right enough if they would bring better stuff in.

6209. Yes, but you see evidently there is a demand for the stuff that is made with the bad yarn; and so long as there is a demand someone will make it. Who is to make it?—The weavers have to make it.

6210. Those weavers will want the steam, will not they?—I daresay the biggest majority would do without it.

6211. But somebody would have to make it?—Yes.

6212. What about those other people; they would have to have the steam, would not they?—You know some are better adapted to it than others.

6213. They would have to pick out the weavers for the wet sheds. At any rate, you think that it makes you uncomfortable?—Yes.

6214. We have had some very hot weather this year. Did you feel it specially on those hot days?—We sweat like a bull, as you may say.

6215. Who regulates it in your shed; who turns it on and off?—There is a young man; he has gone on overlooking now and they are getting a new man on. He has been on about a month. Him has got to overlooking that regulated it at first. Now a young fellow has to regulate it, and he will not be experienced to it yet.

6216. Supposing that you were getting bad results, that you are not weaving well, would you turn on that yourself a bit?—No, we are not allowed.

6217. No workers touch it?—No hands, only the man that is appointed for it.

6218. Have you formed any opinion as to whether there is sometimes too much or sometimes too little?—Yes, sometimes they put too much in and sometimes too little.

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6219. Which do they generally do, put in too much or too little?—They put more in.

6220. They put too much in, you think?—Yes.

6221. Have the workers ever made any representation of that sort, that too much is being put in?—They have often grumbled. They grumble at the young fellow that looks after it.

6222. What sort of ventilators have you?—Humidifiers.

6223. Do you mean the air?—They are slanting at the top.

6224. A big thing with a top—Hart's?—Yes.

6225. (*Mr. Shackleton.*) A long trunk system?—Yes, they slide them.

(*Mr. Higson.*) It is really Parson's or Pye's.

6226. (*Chairman.*) With that system of humidifying, sometimes the air that comes in is much cooler than at other times, is it not?—Yes.

6227. I suppose on a very hot day when the air comes in it cools the shed down a bit?—Yes.

6228. Is it agreeable then?—It does not cool it down that much.

6229. Does it make it better?—Yes, it makes it better.

6230. Under the system you have do you get any draughts?—Not much; not where I work.

6231. Do you hear any complaints about draughts?—There is one young fellow complained about it, having a stiff neck, but that was in winter time.

6232. Is that the only instance you can give?—That is all I know of.

6233. (*Mr. Higson.*) You said that you think it would be better for your health. You have worked at — the biggest part of your time, have not you?—Yes.

6234. Have you suffered anything?—I have not suffered much.

6235. What is the nature of your suffering?—The influenza, that is all I have known.

6236. You speak about this: that steam could be done without if better stuff were put in?—Yes.

6237. Did you ever think how much it would cost to put better stuff in and do without steam?—No.

6238. Who has got to weave it? It has to be made, you know?—Somebody would have to weave it.

6239. Some time you will find out how much it would cost to put better stuff in, as you say; then you would not have the results that you think you would have. In yarn that is sized like —'s is sized you would have to have it softened by some means or other?—Yes.

6240. You agree to that?—Sometimes you know it is very stiff when it comes in, and sometimes it is very soft.

6241. (*Mr. Thomas.*) What you mean is this: if you had an opportunity of working in what we call a dry shed or in a wet shed, and you could earn the same amount of money in each shed, which would you prefer?—The dry shed.

6242. Why?—Because if you work in a damp shed it stands to sense it will give you rheumatic.

6243. Does this give you rheumatic?—Yes, there is some of us playing with rheumatic.

6244. (*Mr. Higson.*) You said you had not suffered from it?—Some of us have; I have not.

6245. (*Mr. Thomas.*) Working in a humid shed or steaming shed you think is not comfortable?—I prefer where it is dry.

6246. You think it is more comfortable in a dry shed?—Yes.

6247. (*Mr. Hartley.*) Have you ever worked in a dry shed?—Not that I know of.

6248. Then how do you know you prefer a dry shed?—I have worked in about half-a-dozen, but not so very long.

6249. You say you do not like steam. Supposing there were never any hot weather, would you dislike it? If it were always winter time, would you dislike it?—It just depends what they put in then to heat the shed without steam.

6250. I am assuming that they keep the shed comfortable. I want to know is it only in very hot weather that you dislike steaming?—That is all.

6251. It is in very hot weather?—Yes.

6252. If it were taken out in very hot weather you would not complain?—No.

The witness withdrew.

Miss E— B—, called in and examined.

6253. (*Mr. Higson.*) You are a weaver?—Yes.

6254. Where do you work?—At —'s.

6255. How long have you been a weaver there?—I have been there years, but I worked for —'s firm before at — Mill. I learnt under —

6256. You have worked for that firm all your life practically?—In between I went to —.

6257. You know there has been a good deal of talk about steam in weaving sheds, and some say it could be done away with, and some do not say much about it, and some say it makes them poorly?—Yes.

6258. You work in a steaming shed, what is your opinion?—I have always been in a steaming shed ever since I was twelve. It has never affected me. Everybody is not alike. I think we could do without it if the stuff were better.

6259. You could do without it if the stuff were better?—We could not do without it with the stuff that we have in.

6260. (*Chairman.*) You personally have never suffered on account of the steam?—No.

6261. Do you think it is necessary for weaving the stuff that you do weave—would the stuff weave without the steam?—It would weave without the steam if the stuff were better. It would not with the stuff that is in; it would be impossible to do without it altogether.

6262. Have you suffered very much from the heat this last summer? We have had some very hot days, have not we?—It has been hot anywhere this last summer.

6263. Do you think that the steam makes you feel it more or not?—It is hot inside.

6264. And it is hot outside?—Yes.

6265. Do you go home to dinner?—Yes.

6266. When you get out in the middle of the day into the yard or on the way home it is very much cooler than inside the mill, or is it pretty much the same?—It is cooler outside than in.

6267. (*Mr. Shackleton.*) When you get home at night after a hot day in the weaving shed do you feel tired or in any way weary?—No, I do not, because I am used to it. Everyone is not alike. Some if they have anything to do with them go home.

6268. When you get home are you always ready for your food?—Yes, I am all right.

6269. How many looms have you?—Four; I have had four ever since I was fourteen.

6270. When you say that stuff would weave better, or that it would be all right if you had better stuff, what do you mean by that—do you mean that the stuff will not weave without steam or that the stuff does not weave well at all?—When it has been had they have blamed the crop before and all sorts of things.

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6271. In the shed that you work in at ——'s do you hear any complaints about the steam at all from the weavers?—No.

6272. As a matter of fact they have all been brought up with it, and you do not know the other side of it; you do not know what it is to be without it?—That is so.

6273. (Mr. Cross.) Which shed do you work in at ——'s?—The new shed.

6274. Is that shed much cooler than the other?—I think they are nearly both alike to me.

6275. Have you heard any expression as to one shed being cooler than the other?—They come out and say one is cooler than the other, and when they come out of the other they say the same.

6276. On hot days what part of the day troubles you, which part of the day do you feel most unfit?—When it gets about half-past ten or half-past three you generally feel the want of a bit of something, but I never make a practice of having anything.

6277. Do you know anybody that has worked in both sorts of sheds—steaming sheds and dry sheds?—No, there are six of us brothers and sisters, and they have all been brought up to the same; and there is none of us affected that I can see.

6278. No friends of yours are affected?—No.

6279. So you do not know the difference of being without steam and with it?—No.

6280. How long have you been at ——'s?—It is three years at Whitsuntide since I went this last time. I was at ——'s three years.

6281. Do you prefer ——'s at —— or ——'s shirtings?—There is a lot more work at the coloured.

6282. What sort of a shed is —— to work in compared with ——'s?—The new shed is a very nice shed.

6283. Better than ——?—There is plenty of ventilation. They have the humidifiers there the same.

6284. You have really no idea about its being harmful to the weavers?—I do not mean to say it does any harm; I cannot when it has not done any harm to us. My little lass has been in the shed since she was 12, and she has never been ill since she has gone in.

The witness withdrew.

Mr. WILLIAM ISHERWOOD, called in and examined.

6301. (Chairman.) You are manager where?—

6302. That is a very extensive mill, I think?—Over 3,000 looms.

6303. In the weaving sheds do you use artificial humidity right through?—Yes, except one shed with Northop looms in.

6304. What method of humidifying have you?—By fan extraction and steam.

6305. That is, you have steam jets?—We have steam jets and extraction fans.

6306. Any special inlets?—No, not in that place.

6307. I am not talking of the Northop looms?—We have no special inlet in any place.

6308. You ventilate in the humid sheds?—By Hart's humidifier only.

6309. What did your last answer apply to—to Northop looms?—The Northop looms is only by steam and one extraction fan with no special inlet.

6310. I thought you did not humidify where Northop looms were?—Yes, we blow off steam.

6311. (Mr. Shackleton.) That is a distinction between humidifying and blowing in by steam. Some manufacturers make a distinction. They call it humidify-

6285. (Chairman.) Is that your daughter?—Yes.

6286. How old is she now?—Fourteen.

6287. (Mr. Thomas.) Were you working there on Wednesday when we went through?—I was off that half-day. I went back in the morning.

6288. You were working during the morning?—Yes.

6289. You were not working in the afternoon?—No.

6290. Do you remember on that Wednesday morning whether it was hotter or whether it was cooler, or whether it was more comfortable, or what?—It went a lot cooler when they turned the steam off.

6291. I mean that Wednesday morning. Can you remember whether it was more uncomfortable or was it better than other times?—It was just about the same as it was the day before.

6292. (Mr. Cross.) It feels cooler when the steam is taken out?—Yes.

6293. Is it pleasanter then?—It is more pleasant.

6294. Was it more pleasant to you when the steam was out both in your weaving and the feeling that you had, than what it was before the steam was turned out?—Yes.

6295. You could go about your work with more alacrity?—Yes.

6296. You did not feel the same oppressive feeling?—You feel in better form for work when cooler than when hotter—anyone does.

6297. (Mr. Thomas.) Supposing you were working in the warehouse, and not weaving, would you prefer to have steam or not to have steam?—I should not care to have steam in the weaving shed if we could do without it.

6298. You think the steam helps you to weave better?—Yes.

6299. That is really why you like it if there is such a thing as liking it?—Yes. If we could do without it I prefer being without it.

6300. (Chairman.) I gather that the Witness thinks it is necessary for the weaving purposes. She personally has not suffered in health, but she would be more comfortable without the steam.

(Mr. Thomas.) That is the sum and substance of it.

ing when they have a machine for the purpose, but steaming is the ordinary live steam.

6312. (Chairman.) Take now not the Northop shed but the other sheds. You tell us you have Hart's humidifier?—Yes.

6313. How many of Hart's machines do you have to a given number of looms?—We have 21 for 3,300 looms odd.

6314. First of all, from a weaving point of view, do you find them satisfactory?—From a weaving point of view they are.

6315. Do you let steam in all the year round or do you sometimes turn it off?—Do you mean the steam for humidifying or for drying?

6316. For humidifying?—Never. We always put steam in.

6317. Of course you keep a record of the difference between the bulbs?—Yes.

6318. Have you formed any opinion as to what is a necessary difference between the bulbs for satisfactory weaving?—I do not understand. Between what?

6319. Between the wet and dry bulb, how many degrees?—For weaving purposes about $2\frac{1}{2}^{\circ}$ to 3° . I think when you get to 2° you are rather over-steaming, particularly in the mornings when you are bringing cold air in. That is the time when you get wet walls and wet pillars, and wet clothes.

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6320. (Mr. Cross.) That is 2° between wet and dry?—Yes.

6321. (Chairman.) You would put as an extreme limit what?—I should put the limit from three to four.

6322. Supposing that it were laid down that the wet and the dry bulb should not get nearer than 4°, would that interfere with your weaving?—It might slightly, but I think it interferes more now by getting too damp, and having disadvantages otherwise. It interferes with your straps, makes them sticky, and runs down your pillars. At 68–70° is really the best weaving. That is the difference between the two.

6323. (Mr. Shackleton.) You cannot get any nearer than that under the Act?—No.

6324. I understand you to suggest you would have it from 3° to 4°?—I would.

6325. (Chairman.) 68–70° is about 88 per cent. relative humidity?—There is this one point I would like to say that that is more needed in case of heavy sizing. The two really is not needed at all unless you are very dry sized.

6326. You know, no doubt, that many people hold that the trade could be carried on without any steaming or artificial humidity?—Yes.

6327. What is your opinion upon that question?—Well I think it could be done; but, of course, it would take some time to get to it, and it would have to be altered in the sizing—a lot of it, but in a cold dry weather there is no doubt about it—I do not think it could be carried on then unless you get your size suitable, though I have been a weaver when there was no steam.

6328. You think that there are at any rate some days upon which artificial humidity or steaming is a necessity?—Yes, I believe so.

6329. That is for satisfactory weaving?—Yes, and there are some days when the hands would insist upon having steam during dry winds.

6330. You think they would strike if they did not have it on certain days?—I think they would in cold dry east winds unless it was agreed upon all round that there was none to be in. Then the thing would be different, would not it, but I think they would, because you cannot weave in some very dry atmospheres.

6331. Supposing, for the sake of argument, everybody agreed to do away with it, and you had a week of easterly winds how would you get on?—I should try to alter my size for it.

6332. Do you think that you could successfully alter your size so that the weaving could be carried on?—I am under the impression that it can be done.

6333. Then you think it is a possibility to do away with artificial humidity or steaming—I use both those words, because some people use them in a different sense?—I think there is a possibility of doing away with it, but I do not think it is advisable to do away with it altogether, because I think if you get 4° between the wet and the dry bulb you would not have any difficulty with any weavers.

6334. You think there are some advantages in it?—Yes.

6335. Do you think there are any disadvantages in it?—Yes.

6336. What are the disadvantages?—The disadvantages, in my opinion, are these: that in summer time you are steaming, and then you try to bring your air in cooler by different processes, and to bring cold air into any warm atmosphere in the shed creates a draught. Whatever you do in a shed where it is hot and you bring cold air in or put water in you will have somebody off bad. I will guarantee that with degging there is somebody off sick within two days. I have seen Hart's humidifiers at work, and that is not comfortable to a weaver when you bring in cold air.

6337. Take a very hot day. We will suppose there is a dry shed and a humidified shed; that the temperature to start with is the same in both, but in one

there is artificial moisture; which would be the more comfortable one to work in?—If it were put in by low-pressure steam I would rather have the steaming shed. I would not have it if it were put in by injector fans bringing air from the outside. That is the worst kind, in my opinion.

6338. You think that working in a damp atmosphere is as comfortable as working in a dry atmosphere?—Up to 4°, the difference between the two bulbs. My experience is that I have more people off always when there is a fog or any time in colder weather than any time when you have hot weather in the hottest season of the year and you have more complaining, because you are bringing cold air into a warm place.

6339. That looks as if cold is bad for them?—There is no doubt about it, it is bad for them at that point. My experience is this: I think that steam put in well-covered pipes and at a low pressure and extraction fans is the best way of humidifying; that is, providing you have no closets opening in the sheds or weaving rooms; if you have them it is very bad.

6340. Where were you employed before going to this mill?—I came from —, Blackburn, and have been with two of the largest manufacturing firms in Blackburn.

6341. Are all those mills in which there is moisture introduced by one method or another?—Yes.

6342. Have you had any experience in a dry shed?—No, only for a day or two at a time.

6343. How did you get on then?—It all depends on the weather. There is no doubt that weather has a great effect on cotton, both in spinning and weaving.

6344. (Mr. Hartley.) What kind of goods do you make; are they heavily sized?—No, pure size about 20 to 25 per cent.—printers.

6345. You have never had any experience of the plenum system of ventilation, that is, bringing air from the outside and conditioned in the fan itself?—Hart's humidifiers all bring air in.

6346. I do not mean that. I mean the ordinary roof fans with steam coils inside the duct. In Hart's you are mixing steam with air, are not you?—Yes.

6347. And you are warming that, too, at the same time?—Yes, up to 70°.

6348. (Mr. Cross.) No, you are sending it out of the perforations either warm or cold, but you send the steam out from the bottom of the ring.

6349. (Mr. Hartley.) What were you referring to when you spoke about weavers getting draught—was it when they got this cold air from outside?—I have never seen any yet that did not do it more or less. If you bring cold air in, when you warm the air coming in to the same temperature as you are at inside, then, of course, there is no difficulty. You are allowed to heat it up to about 70°, if I remember right. Supposing then you turn steam out of your coil, that immediately brings cold air in, and those underneath it will complain.

6350. I will put it in another way. You have no experience of dry sheds at all, or of the ventilation of dry sheds?—No.

6351. So that you could not help me. What I wanted to know was whether it was possible to keep the air brought from outside to a temperature, so that the weavers would not feel draughts?—Yes, it is.

6352. It is possible?—Yes.

6353. And if the air could be warmed up to 65° or 70° there would be no complaint you think about ventilation, no complaint about draughts?—I do not know. I would not like to say. It depends on the heat inside the shed. If you go into a weaving shed you can tell when you go near them.

6354. You have had no experience?—Not in dry sheds.

6355. (Mr. Cross.) You think it would be a mistake to do without steam altogether?—Yes.

6356. You say your goods are 20 per cent. pure size?—Yes.

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6357. Light sized goods really. Could not you do without it in your place with some alteration in the size?—I say it would be possible if the size were altered, but I could not say that I could do it right off.

6358. What would the evil be in your place?—I should have to change the size.

6359. That would be all the difference in the proper cost?—If it lowered the production there would be a bigger cost.

6360. Do you think you could do that so as to retain the productive capacity of your machinery and so that the weavers retained their wages in the class of goods that you make?—Well, it may be possible, Mr. Cross, but I would not say until experience took place. You see you size with a heavy flour size and you get a somewhat harder cloth. It is not the same as sizing sixties twist to make it weave. But I believe you could do it.

6361. There are mills in the county which do without steaming?—You can put chemicals, but where you put a pure flour size it would be difficult.

6362. Have you any knowledge or experience in the number of workpeople that you have had control of that they have made complaints to you that they did not want steam?—Yes, I have heard people say that they did not want it, and I have heard people say that they did want it.

6363. Which would preponderate, those that did not want it, or those who desired it? Take the Blackburn area, for instance?—I would not say whether they would or not. If you take the case of a shed making either shirtings or printers I have no doubt they would prefer steam.

6364. Do you think the workpeople would?—If you could take fine places probably they would be without.

6365. (Mr. Thomas.) Do you know of any firm near your place that makes Cheshire printers without steam?—I do not know any except one near Preston.

6366. Are a number of firms in Burnley making Cheshire printers?—I do not know.

6367. Are you aware that there are a number of firms?—I have heard so. There are a number making our goods without steam at all.

6368. Would you be surprised to know that the average is very big, and biggest in Burnley?—It may be so; I do not know.

6369. It is quite conceivable?—I do not know it.

6370. Is it conceivable to you?—Is what conceivable?

6371. That a firm in Burnley making Cheshire printers have bigger average than one making a Burnley printer without steam?—There are different ways of getting an average, and there are different conditions of sheds. We have six places. The conditions are different, though they are all within a quarter

of a mile. When I was at Blackburn there were different conditions. There are different conditions in every shed.

6372. In your place you are making Cheshire printers?—Yes.

6373. You are using steam?—Yes.

6374. Is it essential that steam should be used to make a Cheshire printer?—It is for good weaving. It is possible that it can be done if you go and buy the best of yarn that can possibly be made and the best of weft that can possibly be made

6375. Are those the only conditions under which you can get Cheshire printers?—No, I believe you can make your size to do it, but there will be difficulties in dry east winds the same as others have.

6376. (Mr. Cross.) Is the evil that you indicate in your remarks this: does it mean if you did without steam you are going to have less wages, more work, and less production?—It would be so for a time.

6377. That would be no longer than, say, the life of your shed. I mean by that the length of time the beams would last, say, a month?—You could not say at once that you could change a thing like that with no practical experience. It might take a bit to make the change. You might have to experiment a bit before you could do a thing of that sort.

6378. Assuming there would be a bother with the size, what do you think would be the increased cost of improving the yarn?—I do not know that.

6379. You could not give us any idea of that?—I could not give any idea of that. You would have to make some material changes in those things. It would alter the feel of the cloth.

6380. But it could be done?—I think it is possible to be done.

6381. With satisfactory results do you think all round, that is, production and wages, for they go hand-in-hand together?—I would not say you would get the same for a time.

6382. But ultimately?—There are days as you know, in summer time, and there are days in winter time when with all the steam you can put in it is not satisfactory for weaving.

6383. Could not you counteract that by having the pipes radiating warmth?—If it was a dry east wind or a dry hot summer day you would not get it. What could we do with the weaving only a fortnight ago? We were bringing in the air at 84°. We had to have a little steam in them. That was rather difficult weaving under any circumstances.

6384. On the question of a particular size being used, it would have to be a size that would not require softening; but if we had a size equivalent to it so as to do without steam, of course, we should not feel the worst effects of the east wind, should we?—I should not like to say to be sure on that, Mr. Cross.

The witness withdrew.

Miss L—— H—— called in and examined.

6385. (Chairman.) You are a weaver?—Yes.

6386. How long have you been a weaver?—Five years.

6387. Where have you worked all that time?—At —s.

6388. (Mr. Shackleton.) You come from —?—Yes.

6389. (Chairman.) Have you had good health all the time?—Yes, I have had very good health.

6390. They use steam there, do not they, in the shed?—Yes.

6391. You have some steam jets where the steam comes out into the shed?—Yes.

6392. Do you like working with the steam?—Yes, it has never made any difference in our place.

6393. It does not make you feel uncomfortable at all?—No.

6394. Have you heard, in other mills complaint about the steam at all?—No, I have not heard them say anything.

6395. I suppose in the summer you have had some very hot days?—Yes.

6396. In the last few days you have had some very hot days? About a week or ten days there were some very hot days, were not there?—Yes.

6397. Were you very tired after the day's work?—Not particularly.

6398. I suppose you have never worked in a shed where there is no steam?—I have not.

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6399. During all the years you have worked you have not been ill at all, or you have not been off ill at all?—No.

6400. Have you never had to go to the doctor?—No.

6401. (*Mr. Hartley.*) How many looms do you mind?—I have two of my own, but go on four for sick.

6402. In winter time do you notice whether the warps weave badly?—Sometimes we have bad weaving in winter time.

6403. On frosty days?—Yes.

6404. (*Chairman.*) Is the steam ever turned off on working days?—Yes, the manager goes up many times and turns a little off.

6405. Does it make any difference to the weaving when they turn it off?—Sometimes it does. Sometimes we have worse weaving than others.

6406. Does it make it weave better or worse?—We have better weaving with steam on, in our place.

6407. (*Mr. Thomas.*) Which shed do you work in?—Shed.

The witness withdrew.

Mr. A— J— L—, called in and examined.

6408. (*Chairman.*) Are you a weaver?—I am a weaver, a four-loom weaver.

6409. How long have you been a weaver?—Twenty-eight years and a quarter.

6410. Where do you work now?—At —, the —.

6411. That is the — Shed of —?—Yes.

6412. How long have you worked for that firm?—Twenty-eight years.

6413. I did not know that you meant for one firm; was it all the time with that firm?—All the time I have been in — I have worked for the one firm.

6414. During that time have you used steam—all the time?—Oh, no. In my old days they used not to use steam in the summer; just a jet or two blowing off in the winter.

6415. What do they do now?—They are blowing off winter and summer now.

6416. How long have they been blowing off winter and summer?—Ever since they have been up that I have known.

6417. (*Mr. Shackleton.*) How long is that?—I cannot tell you how many years they have been up.

6418. (*Chairman.*) Tell us as nearly as you can?—They have had two lots. Four or five years as near as I can guess; it might be longer or it might be shorter.

6419. That is four or five years they have been steaming, winter and summer?—Yes. I do not know what sort of steam is coming out, cold or warm.

6420. Tell us was the weaving better before the days when they steamed summer and winter or is it better now?—I do not know. The looms are speedier now than they were then. It is quicker, but the weaving were better in the old days than it is now.

6421. (*Mr. Cross.*) What is the difference in your wages then and now?—23s. and 24s., but then there is the discount on now that there was not then.

6422. (*Chairman.*) I do not suppose the scale of wages was the same in the old days as now. We will get it all out. I want to know in the first instance whether you think that the steaming has improved the weaving?—No.

6423. I am not talking of wages; I am not talking of health; I was simply talking about the weaving. Has it improved the weaving or not?—No.

6424. Do you think you could weave as well without steam?—If the work is made better.

6425. It works better without steam?—If the work is made better.

6426. You mean if there was a better warp?—Yes.

6427. I am not talking about that. Supposing that you had the same warp, can you weave better with steam or without?—I could not do that. I would have to have steam with the present work I have on now.

6428. Now we come to another point. Do you consider that the worker, the weaver, is more comfortable with steam or without steam?—It is better without steam.

6429. It is more comfortable?—Yes.

6430. Do you think that the steam does any harm to the workers?—Yes.

6431. You think it does?—Yes; steam is no good to anybody.

6432. In what way does it affect the health of the workers?—Colds and rheumatic. It is the steam and the cog wheels that are the cause of my deafness.

6433. You have told us that you think steam is bad for the health of the workers?—Yes, it is bad for the workers.

6434. How does it affect them; in what way does it make them bad?—There is rheumatic, for one thing. I think this influenza is another thing, and I think there is a good lot of gathering in the faces.

6435. You attribute that to steam?—Yes, I think so.

6436. Apart from health just take simply comfort in working; what do you say?—There would be a lot better comfort without steam than with it.

6437. (*Mr. Shackleton.*) In the hot days what is your impression when you leave the shed; how do you feel at night?—You feel worn out and jiggered up; we feel fagged out; we cannot do anything when we get home.

6438. You say since they have put the steam in they have increased the speed of the machinery somewhat?—It was increased a bit before; not so many years before; but when I started the looms were not going 200 picks a minute, as they are now. What I am on goes 202.

6439. Your impression is when you have finished work that you are tired?—I am ready for bed.

6440. You feel ready for a good feed?—No, I do not want a feed; I have had enough, and it is the steam that is the cause of that.

6441. (*Mr. Hartley.*) You think that is the steam?—It would make anybody sick; it would make a woman sick, never mind a man.

6442. Are you very tired, say, in January and February?—That is the cold time, is not it?

6443. You are steaming then?—We just feel then as we ought to do in summer, the same as a man who works out of doors.

6444. (*Mr. Shackleton.*) What he means is this: that after a day's work in January and February they feel as they ought to do in summer, that is to say, comfortable as they come out.

6445. (*Mr. Hartley.*) You have just told us you think it is due to steam that you are so tired and jaded?—I do think so.

6446. You are steaming in January and February. Why does not it have that effect then?—It is not the warmest time of the season as it is now.

6447. Then it is only when you have very hot weather you object to steaming?—If it is the steam that does it in the winter time in the big shed, they have to heat it or they could not work.

6448. Would you yourself object to steaming in the winter months?—I do not believe in steaming at all. We should have to have steam in the shed, but not blowing off.

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6449. I mean blowing into the shed; would you object to it in cold weather yourself?—Yes, I would. I work against the door now.

6450. On what ground do you object?—The blowing off it is against the health from the dampness coming into one's clothes.

6451. Have you experience yourself of suffering?—Yes, I have just told you I have deafness through steam.

6452. You said through the wheels?—I said through steam and cog wheels over my head.

6453. You think that has made your ear bad?—Nowt else.

6454. Do you know anybody who has suffered from

rheumatism?—It is a big place to tell who is off and on; you cannot miss them.

6455. You say that steaming brings on rheumatism, gatherings in the face, and influenza?—Yes.

6456. Do you know anybody who is suffering from rheumatism?—An old gentleman who is against me and he works under one.

6457. What age is he?—Getting into seventy now, I daresay. I do not know the man's age to a year or two.

6458. That is the only case you know, is it?—About where I work; I do not know for anywhere else.

6459. Your principal complaint is that the steam raises the temperature in hot weather?—Yes.

The witness withdrew.

Mr. CHARLES HENRY TURNER, called in and examined.

6460. (Chairman.) Are you a partner in Samuel Turner & Co., Limited, Rochdale?—Yes.

6461. The business of the firm is?—Cotton manufacturers.

6462. And spinners?—Not spinners.

6463. How many looms?—About 2,000.

6464. At the present time you are not using any artificial humidity?—No.

6465. At one time I think you did?—Yes, we brought ourselves under the Act for a short time.

6466. At that time what method of humidifying did you adopt?—It was no well-known system of humidification and it was not put in for the purpose of humidifying either, but more for the purpose of washing the atmosphere that was used for the sheds.

6467. In general terms it was for passing air through a current of water?—Yes, through a spray of water.

6468. I think your idea was to purify the air, and reduce the CO₂, I daresay?—Yes, that was the idea, to make it more agreeable.

6469. Why did you give it up?—We gave it up: because for one reason it was a very clumsy system, and we did not think it scientifically accomplished, and we found on the very hot days that the moisture in the air as put in by us made it seem rather oppressive.

6470. At the present time you are ventilating. Perhaps it would be better for you to describe your present method of ventilating?—Simply forced admission of air.

6471. Distributed?—Distributed through pipes.

6472. With apertures?—Yes.

6473. I want to know the position of the apertures through which the air reaches the rooms; are they on top or underneath?—They are above the head, and the current goes up—the inlets are surrounded by discs.

6474. I take it that the outlets were put in that position to avoid a direct draught on the workers?—Yes.

6475. As the result of experience have you found that direct draughts reached the workers?—No, we do not get any complaints.

6476. You have had no complaints with regard to draughts?—None particularly.

6477. Would you tell us in general terms what class of goods you manufacture?—I should call them light coloured goods.

6478. What size is used?—Pure size, very light size indeed.

6479. (Mr. Shackleton.) Do you mean pure flour size?—Not necessarily. Perhaps pure is a wrong term. I ought to say light sizing.

6480. (Chairman.) Do you find that you can carry on your weaving successfully, in a satisfactory manner, without the aid of artificial humidity?—On some

days, yes. I do not know—we have never tried to humidify our shed scientifically, but there are days in the year, particularly frosty days and when the wind comes from the east, when the atmosphere is certainly too dry for advantageous weaving. On those days we simply have to suffer through lack of humidity.

6481. Can you tell us approximately the number of days in the year when you are inconvenienced in that way?—No, it varies, of course, very much.

6482. It varies from year to year, but can you give us an approximate idea?—I am afraid I could not even roughly, we have not noticed it.

6483. Take one of those days, can you give us any idea of the proportion in which the output would be lowered?—It is considerable, but percentage is a very difficult thing to get. You can only tell exactly one day with another; by observing how the machines are being kept on; but I should think if we had a complete week of frost our average would go down 4d. per loom.

6484. You think it would go down 4d. per loom in wages?—Yes, that is roughly; I cannot give you an absolutely correct idea.

6485. I take it that if this reduction in wages had gone on for any considerable time it would probably have been rather impressed upon people's memories, would not it, and the workers would probably come and make some representation?—I think they understand that the thing is inevitable. In a shed like ours they know perfectly well what the atmosphere is like, and it is common talk with them that the work is not doing so well on certain days.

6486. As a matter of fact you have not found it necessary on any occasion to say that the weather conditions are such that we have no humidity and cannot weave satisfactorily and so we will close the mill?—No; in the biggest part of the year for our particular class of work we do not need humidity; there is no doubt about that.

6487. Have you considered the question at all from the health point of view, whether the workers are more healthy where there is artificial humidity or where there is not?—No, I simply know what I have read; I have had absolutely no experience of a shed that is scientifically humidified myself; we have never been in the heavy trade at all.

6488. (Mr. Shackleton.) I should like to ask a question with regard to the short period in which you have had humidity, not for the purpose of humidifying, as you say, but you have felt yourself, I think, the difference in the bodily feel?—Yes.

6489. And workpeople have felt it and made complaint?—Yes.

6490. And you took records?—The records we then took we sent on to a Government office.

6491. At what period would that be?—It was I think for about a whole year. It was at the summer time of the year when the nuisance was felt.

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6492. How long ago?—It is six or eight years ago, I should think.

6493. The reason I ask the question is this: it is admitted, and I think you agree that there was some difference, and the weavers felt that?—Yes.

6494. I wanted if possible to find out what degree of humidity you were putting in, though not for the purpose of humidifying. The record would show what the difference was between the wet and the dry bulb, and it is rather important to know how much humidity you had in?—I see your point, but we destroyed our counterparts of those sheets which are in the hands of the Home Office somewhere. They can be traced.

6495. You also say that even in the frosty part of the year or in the east wind part of the year it would not make much more than 4d. per loom difference if there was a full week of frosty weather?—I should assume that with our class of goods. It is a very rough estimate. It is very difficult to say. You rarely get a whole week when you have nothing but an east wind or a severe frost.

6496. It is not a very serious matter, of course, but the weavers would have to work harder that week, and although there was 4d. reduction per loom, they would probably work harder to make it up?—The yarn breaks oftener, and that has one of two effects. Either they have to work harder or the production goes down.

6497. The production goes down 4d. per loom?—I should think so.

6498. You really are of opinion from the short experience you have had that there is a wonderful difference in your shed between a dry heat and a humid heat?—Yes, I have no hesitation in saying that; that is well known anywhere.

6499. (Mr. Thomas.) How long have you had mechanical ventilation?—Ever since we built the shed; it was put in at the time. I should think it is fourteen or fifteen years since that particular shed was built.

6500. Are you satisfied with the health of the operatives?—I think that particular shed is pretty healthy. I do not say it is a scientific system, but we get plenty of fresh air. The capacity of the shed is, I think, 1,000,000 cubic feet; we send about that amount through the fan per hour.

6501. You think it is worth the trouble and expense?—Yes, we do for our own particular class of work certainly.

6502. (Chairman.) Have you ever tested the atmosphere from the CO₂ point of view?—No, but I think some samples have been taken. I do not know the result of the test. Mr. Wilson took those. We never went so deeply into it as that.

6503. (Mr. Hartley.) You have told us that you are in the coloured goods trade?—Yes.

6504. With the class of goods manufactured you must of necessity buy the very best quality of yarn?—Yes, it is good yarn.

6505. You have a good reputation to maintain for a very good class of home trade goods, and your yarn consequently would not be adversely affected so much in an ordinary way by east winds or frost?—I should take it that it would suffer a little less than a lower quality.

6506. Is not it generally the fact that the manufacturers in your class of trade do not humidify, or do not need to humidify, because they have to purchase a higher quality of material than is generally used in the grey trade?—The fact is that they do not humidify; I do not know that the reason is on account of the quality of yarn so much as the fact that it is lightly sized.

6507. It is not necessary for manufacturing purposes to humidify?—No, and it is not customary.

6508. Is not there a further reason that you could not do with much humidity where you have colours that might possibly run—fugitive colours?—There would have to be very excessive moisture to cause that, and it would have to be free.

6509. With regard to this ventilation, you have had some years' experience of it now?—Yes.

6510. You keep it working, I presume, in winter time?—All through the winter, except I think I told you that the last winter was the first winter on which we had ever stopped it, and that was on account of the new system of lighting which we put in. That system of lighting does not raise the temperature of the shed at all; and consequently during the early part of the morning, from six to eight o'clock on every frosty morning, if we have the whole of that fresh air going in we cannot warm it quickly enough with our system, and we have had to stop it for the sake of the operatives and for the weaving as well.

6511. In winter time you have had no difficulty on account of the weavers feeling draughts from this system?—We have not.

6512. Although you have not conditioned the air?—It is slightly conditioned; it is up 10° or 15° inside the fan-house immediately after it has passed over the coils; but it loses some of that on its way to the shed through the cold tunnel and pipes.

6513. You can raise it 10° or 15°?—Yes, but it is not so much above the ordinary atmosphere when it gets into the shed.

6514. You think the weavers would not feel a draught even if it were 10° or 15° lower than the temperature of the room?—Not the way we put it in; we have so many outlets coming into the room.

6515. (Chairman.) It is diffused?—Yes.

6516. (Mr. Hartley.) About this lighting. I rather wanted to get something on the notes about that. It is the Selas light, is not it?—Yes.

6517. That is a system of putting gas under pressure, is not it?—Gas and air.

6518. And you can do with half the number of lights, I suppose?—Yes, you can do; the unit of candle power is 80, as against 16 for the ordinary flat gas burner.

6519. What is the figure for the ordinary incandescent burner?—It varies; it is about 60, I should think.

6520. At any rate you have more than double the light?—You get five times the light of the ordinary open gas burner.

6521. (Chairman.) Is the pressure done in the lamp?

6522. (Mr. Hartley.) They take hold of the gas as it comes from the mains and put it under a pump?—Yes.

6523. Have you noticed that the air is less oppressive in the morning and evening since you have put in this light?—Yes.

6524. Presumably there will be a good deal less CO₂?—I have no tests, but it is not so hot, and it is certainly much more pleasant, and much freer from smell. There is no comparison with the former state of the shed.

6525. We will ask you to give us the approximate cost of this light per loom and also the cost of the ventilation installation?—I have no figures here as to cost of the light, but I can give it to you pretty well from memory. The ventilation as we have it in, without experimenting, would cost, I should think, about £500 for our shed.

6526. That is for 2,000 looms?—They are not quite all in that shed; there are about 1,400. It would cope with more. We could put 2,000 looms on to it.

6527. That is 5s. a loom about?—Yes, it would work out about that.

6528. And the ventilating, what would that be?—That is the ventilating. I should think we have spent upon the Selas gas installation about £1,000 altogether on the two sheds, but I do not know that that would be quite the basis for sheds generally. I ought to tell you that we have put in as many incandescent lights as we had flat lights. We have gone in for a tremendous light rather than for saving anything in plant.

6529. (Chairman.) What about saving of gas?—We have saved in gas 65 per cent. of the gas used formerly.

6530. In a mill of that size how long would it take to get your original outlay back?—It works out this

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way; with a liberal allowance for depreciation and interest, say, 12½ per cent., we come out straight on the first year.

6531. You mean to say it costs you nothing?—The saving in gas will pay for upkeep, including interest and depreciation.

6532. That is an important point?—Yes.

6533. (*Mr. Hartley.*) How many lights do you think you have for your 2,000 looms?—We have 1,400 lights in that shed, for 1,400 looms.

6534. In an ordinary grey place would not one of those lights do for four looms?—Easily enough. Ours is done on a most lavish scale. We have a lot of dark work and fancy work; and we saw that in order to get quality and production we must have a better light in the winter.

6535. Do you think it could be installed at 10s. a light?—The actual light itself costs you 5s. a light, and you can get a 600-light compressor for £190. If you are embodying this in your report, I would rather give you the figures accurately.

6536. I want approximate figures?—Every drop light costs you 5s. Then you have the piping extra to run, and you have the compressor to instal; other than that the power is nothing; it only takes 1 h.p. to drive it.

6537. Five shillings per drop, you say?—Yes.

6538. I thought ten shillings?—I say 12s. per light is plenty, reckoning everything.

6539. (*Mr. Shackleton.*) There is a wonderful difference in the smell and heat of the shed?—Without doubt. I have not the slightest hesitation in saying that.

6540. The reason for this question is really this, that nobody has ever been able to get over the gas-light difficulty?—No.

6541. Neither in a humid shed nor in a dry shed?—I may say without doubt that the temperature is not raised in a dry shed.

6542. (*Mr. Hartley.*) The difficulty in putting in the electric light is that they have not margin of power enough on the engines to undertake it, else that is the best light altogether from the workers' standpoint?—Yes, but not the most efficient.

The witness withdrew.

THIRTEENTH DAY,

Wednesday, August 5th, 1908.

At Blackburn.

PRESENT :

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. J. CROSS.

Mr. WILKINSON HARTLEY.

Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.

Professor JAMES LORRAIN SMITH.

Mr. F. THOMAS.

Mr. D. R. WILSON (*Secretary*).

6543. (*Chairman.*) The operative witnesses to be examined to-day were selected by the Secretary from

lists supplied to him by the District Secretaries of the Weavers' Association.

Mr. J— P—, called in and examined.

6543a. (*Chairman.*) You are a weaver, are you not?—I am.

6544. Where do you work?—Messrs. —, —.

6545. Is that what they call a wet shed—I mean to say have they steaming in it?—Yes, they humidify the place.

6546. How do they humidify—is it steam jets, or how is it done?—It is trunked in.

6547. (*Mr. Shackleton.*) Parson's long trunks?—I really could not tell you the name. They come across the shed in different lengths.

6548. (*Chairman.*) Have you worked in dry sheds as well as in humid sheds?—Yes, I have worked in one dry shed, but not very long.

6549. How long have you been a weaver?—Nearly all my life.

6550. I do not know how old you are?—We will say I have done it for twenty years; put it at that or over.

6551. Out of the twenty years how long have you worked in a dry shed or in dry sheds, and how long in humid sheds?—Only a few months in a dry shed.

6552. Have you seen different methods of humidifying? You know there are different ways of letting

moisture in?—I have seen the jets and I have seen trunking, and I have worked under them both.

6553. Any other system?—No, I cannot say that I have.

6554. Do you know Hart's system?—Yes, but I have never worked under it.

6555. From your own experience which is the best of the systems—I am talking of the comfort of the weavers?—None of them.

6556. That I am coming to by and bye, but of the two you have mentioned one must be better. You say you know two systems; which causes less inconvenience?—I should say trunking.

6557. Have you as a weaver found that you suffer bodily inconvenience, or that you suffer in health, owing to humidity?—I think it is really injurious to health.

6558. Do you suffer any bodily inconvenience from it—I mean to say do you find the work harder than in a dry shed?—I think as it gets towards night you get weary; I do not think it is altogether the work itself; I think it is the conditions of the shed.

6559. Did not you get weary when you worked in a dry shed?—I was not in that length of time.

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6560. Are we to take it that you object to artificial humidity?—Yes.

6561. On what do you base your objection—tell us why you object to it in your own words?—The dampness. I do not think there is any good in working in a damp place.

6562. Why do you object to the dampness: tell us that?—I think it is as bad as going outside and getting wet through; I cannot see any difference myself.

6563. If you went outside and got wet through your clothes would be saturated, would not they, the clothes would be quite wet?—Yes, they would.

6564. Do you find that your clothes get quite wet in the weaving shed?—Not so wet as though outside.

6565. Then it is over-stating the case?—My experience in a weaving shed is that there are certain parts of the weaving shed that are worse than others; for instance, those particular parts that are exposed to the elements, where there is nothing built up against the walls; those are the parts that suffer most, much more than the normal parts of the shed; I am alluding to the outer walls. I say it seems to be colder down those sides, and through being cold it has a tendency to condense that humidity much sooner than at a normal part of the shed, and those are the parts that they grumble most about.

6566. Then if it could be done you would like to see humidity done away with in the sheds?—I should.

6567. You think it would be better for the comfort and the health of the weavers?—Yes.

6568. Let us look at it from another point of view. We have to consider it from every point of view. How would it affect your wages?—I have never tried it, but I daresay they could make the stuff so that it would weave just as well without as what it would with.

6569. What class of goods are you working on?—Heavy goods.

6570. Do you know how much size?—I could not tell you the amount of size.

6571. Is it heavy size?—They are shirtings.

6572. Would not the work be harder; would not the warp break much oftener, and would not there be much more piecing up?—Under this present state of sizing it would be so probably.

6573. How would you remedy that?—By the size mixing.

6574. Any other way?—I do not think it would require any other way.

6575. You think by altering the size that it would be possible to work without humidity and without loss of wages?—Yes, I think so.

6576. By that I mean that the output would be just as great?—Yes, I think so.

6577. (*Professor Lorrain Smith.*) To what sort of size mixing do you think that could be changed?—Well, I really think that more tallow put in the size would just act as well as the humidity on the stuff.

6578. Then one other point. You speak of the condensation of the water when exposed to the cold?—On the outer walls.

6579. Where was the condensation: where did you observe the condensation: on what things was the vapour condensed?—I do not understand you.

6580. On what is the vapour condensed; where does it deposit?—Down the sides of the wall, and it will strike out perhaps for a few yards.

6581. On the floor?—On the wall and the floor.

6582. Not on the other things?—No, it gets better over the normal parts of the shed.

6583. (*Mr. Roberts.*) But it does not strike the clothes of the people, does it?—It must do.

6584. Do they feel damp?—Yes, I have heard them say that they do feel damp.

6585. Did you ever feel damp?—I do not happen to work in that particular part of the shed.

6586. You have never felt anybody's clothes that were damp?—I have not seen.

6587. You have heard them complain?—Yes.

6588. But you never took the trouble to feel at their shirt sleeves?—No, I never took the trouble to do so.

6589. Then you come here telling us what you have heard, not what you know?—I tell you that I have seen the dampness on the walls and floors.

6590. You say that their clothes are damp?—I say it must naturally make them damp.

6591. Then you tell us that somebody told you that their clothes were damp?—Yes, I have heard them say so.

6592. But do you know that it is so?—No.

6593. (*Mr. Hartley.*) On the point of condensation, you say you have seen it on the walls?—Yes.

6594. Do you think you have seen any more on the walls of a shed than you would see in any room that is heated with a lot of people in?—On those particular parts of the sheds you will find it, and you are bound to find it.

6595. I want you to say what you have seen?—I have seen that there has been wet down these particular sides.

6596. Is it wetter than always occurs in a warm room with a lot of people in it?—I do not mean to say a weaving shed, but any room where people are meeting?

(*Chairman.*) Such as a church or a chapel.

(*Mr. Roberts.*) Or a concert room.

(*Chairman.*) Or a music hall.

(*Witness.*) That is packed almost to suffocation, is not it? but a weaving shed is not packed like that.

6597. (*Mr. Hartley.*) I have not got an answer to my question. Have you seen the walls of a shed worse than you would see in a concert room or in any room where a lot of people are congregated and there is heat?—Yes, on those particular sides I have.

6598. (*Mr. Roberts.*) Would you be prepared to sacrifice the humidity and at the same time have your wages go down?—Yes.

6599. You prefer lower wages and no humidity?—Yes.

6600. Rather than the present wages and humidity?—Yes.

6601. If you were told that your wages would go down seven and a half per cent, would you be prepared to say that?—Yes, I would stand seven and a half per cent, knocking off my wages to-morrow to be rid of steaming.

6602. (*Mr. Hartley.*) You have told us that you think the absence of humidity could be met by improvement in sizing?—Yes.

6603. Perhaps your answer to Mr. Roberts just now would be based on that belief?—It is.

6604. You say more tallow could be introduced?—Yes.

6605. Do not you think manufacturers and their managers are doing everything they know to produce a better state of warp?—I could not tell you that.

6606. Do you not think it is to their interest to do it?—If it weaves it is all right to them if they get their length of cloth out.

6607. Would not the manufacturer be gaining if he could do anything to improve the weaving?—In that respect I should not say so. So long as it weaves under his present conditions what difference would there be between him under present conditions humidifying it, and having the humidifying stopped and having tallow put in.

6608. Do you not think that the steam is an expensive thing for the employers?—I could not tell you that.

6609. (*Mr. Shackleton.*) What sort of goods do they make at —?—Heavy-sized goods, shirtings and heavy dobbies and Indian China goods.

6610. Any coloured goods?—Yes, coloured goods.

6611. You have come to the conclusion then that this can be remedied by changing the material or the sizing?—Yes, I think so.

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(Chairman.) I think the witness did not say anything about material. Perhaps you would ask him that.

6612. (Mr. Shackleton.) You think that this steam conduces to a poorer quality of yarn being put in?—Yes, I do.

6613. That is your opinion?—Yes.

6614. And that if you had the steam taken out your view is that the wages would not be reduced anything like seven and a half per cent., but you would probably get a little better yarn—

(Mr. Roberts.) Excuse me, he did not say that. He said nothing about yarn.

(Mr. Shackleton.) I am asking him.

(Mr. Roberts.) But you put it that he said so.

(Mr. Shackleton.) He has said so now.

(Chairman.) Let us understand it. I think I pointed out that Mr. Shackleton made a mistake in thinking that he said anything about material, and Mr. Shackleton is putting it in the form of a question.

6615. (Mr. Shackleton.) You were asked if you were prepared to sacrifice seven and a half per cent. of your wages?—For the abolition of steam, yes.

6616. You are prepared to do that?—Yes.

6617. Do you think that it would make seven and a half per cent. difference to you if you had steam taken out of your mill just as things stand now?—No, not with the material being so made that it would weave.

6618. But as it stands now?—I have never had a chance of trying it.

6619. So you really do not know whether it would be seven and a half per cent.?—No, I could not say so.

6620. What you are positive about is this: you prefer to stand the seven and a half per cent. reduction if they will take the steam out?—Yes.

6621. Are you in a position to state anything about the opinion of other weavers in your mill, as to what has been said generally? A question was asked as to whether you had seen damp clothing or not?—I have never been and felt at it.

6622. But you have heard what they said?—Yes, I have heard them complain about feeling damp and clammy, more especially when they got outside.

6623. That is from the change in the atmosphere?—Yes.

6624. Would you say that other weavers would express the same opinion as you as to sacrificing something to get rid of it?—Yes, I daresay they would if that question were put to them.

6625. As a matter of fact you have had steaming practically all the time you have been a weaver at this mill?—Yes.

6626. You do not know the other side of it at all?—No.

6627. You are tired of the present system?—Yes, I am tired.

6628. (Chairman.) You have expressed an opinion in regard to sizing?—Yes.

6629. That opinion is to the effect that if it was a better size probably the output would be the same even without the help of artificial humidity?—Yes, if the humidity was knocked off it would either necessitate a better material or an alteration in the present sizing.

6630. Have you any practical experience whatever in regard to sizing?—No.

The witness withdrew.

Mr. D— B—, called and examined.

6652. (Chairman.) You are a weaver by trade?—Yes.

6653. How long have you been a weaver?—All my life.

6654. But we do not know how long that is?—Thirty years.

6631. Do you know anything about sizing?—No, I have never had anything to do with sizing.

6632. So far as that opinion about sizing is concerned we may take it as the opinion of a man who has no knowledge of the subject. We want to be clear, because if you have knowledge of that subject your opinion would be much more valuable; if you have not that knowledge it would be better for us to get it from someone who has a knowledge of sizing?—I have no knowledge of sizing, but I can tell from a beam whether it is soft or stiff. A soft beam is more likely to weave well than a stiff beam, in the absence of humidification.

6633. In the mill in which you work is there any place for the weavers to hang up their clothing?—Yes.

6634. Do you think that is a good thing?—Yes, I do.

6635. Of course, you know there are many sheds where there is no such place?—Yes.

6636. You speak about parts of the shed where it is very damp?—Yes.

6637. I suppose clothing hung up in those parts of a shed would naturally become more or less wet?—They are bound to do.

6638. From condensation?—Yes.

6639. Could you suggest anything that would make it more comfortable for the weavers working in those places, I mean to say in regard to hanging their clothes?—Only the total abolition, or a wider margin.

6640. Suppose for the moment that things are going on as they are—I do not say that they are, and I do not say that they are not, but take things as they are, could you suggest anything for hanging up the clothing of the weavers in those places where there is this dampness?—They have the opportunity of hanging their clothes in the cloak room.

6641. But there are some mills where there are no cloak rooms?—Yes.

6642. There are some mills where they say they have no place to put a cloak room?—That is so, then they would have to put them in the mill.

6643. If they put them in the mill would you say little cupboards in the mill would be of any use?—It would keep them dry, I daresay.

6644. (Mr. Hartley.) You told us that you felt wearied?—Yes.

6645. I think you said something about discomfort. You did not use that word, but you said you felt discomfort through this steaming?—I say towards the end of the day you seem to get weary.

6646. Have you noticed whether you felt that, say, in winter time or spring time when it is not so very hot? Does the discomfort begin when the hot weather comes?—Yes, any time, I think, when steaming is being used.

6647. At any time?—Yes, I think so.

6648. No matter what the temperature is?—Well, it does not vary that much.

6649. In winter time it will get from 60° to 70°; in summer time it may rise as high as 90°?—Yes.

6650. Would there be no difference in those times?—There might be a little difference in summer time.

6651. If the steam were stopped in very hot weather that would not satisfy you?—But it would be a lot better.

6655. (Mr. Hartley.) Have you been a weaver thirty years?—Yes.

6656. (Chairman.) Where are you working now?—

6657. Have you worked both in dry and humid sheds?—Yes.

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6658. Will you tell us as nearly as you can how long you have worked in dry and how long in humid sheds?—I should think I have worked seven or eight years in dry sheds, and I have been under steaming ever since it was put up.

6659. Have you worked all the time in one mill or in several mills?—I have worked ever since 1888 at Holmes' mill.

6660. During the first years you were there had they steaming?—Yes.

6661. You had steaming all the time in that mill?—I would not like to be sure, referring back to the start, but I should say it goes into teens of years.

6662. Where was your experience in dry sheds?—

6663. What class of goods did they make at —'s?—Mostly Indian goods.

6664. What did they call them—dobbies?—Yes.

6665. (Mr. Hartley.) You mean dobbie dhooties?—Yes.

6666. (Chairman.) How long did you work at that place?—I learned my weaving there.

6667. Did you find any difficulty in weaving: did you find the ends break very much, or did you find any difficulty in weaving without artificial humidity?—My experience of weaving was that it wove as well without steam as it did with steam.

6668. Did you ever have any steam in that mill?—Yes.

6669. In that same mill, —'s mill?—Yes, I should think we had, but not on the system they have now, more on the pipe system.

6670. And you say that the weaving was as good before they had the pipe system?—It was according to my experience.

6671. How long back is that?—I have worked at Holmes' mill twenty years.

6672. It is a long time ago?—Yes.

6673. Do you think you can trust your memory to say anything definite so long back?—I would not be sure; but I have worked at —'s mill twenty years.

6674. We have to remember that the question was not one being thought of very much in those days, and it is possible you may not have given attention to the question the same as you would now?—No, it is a long time to refer back to for anybody.

6675. Where are you working now?—At —'s mill.

6676. What class of goods do they do in —'s mill?—They are mostly on handkerchiefs.

6677. What system of humidifying have you?—We have Hart's patent.

6678. Have you ever worked with any other system but Hart's?—I have worked with the old jet system.

6679. And I think you said with trunks?—No, I have never said with trunks; I said pipes, which means jets.

6680. Which of the systems that you have worked under is the better for the comfort of the weaver do you think?—They say they put Hart's patent in to benefit the weaver. I would not say that it did not benefit the majority; but you have one, complaint with Hart's patent: that is, those weavers that work round about it have two extremes; you have either too much draught or too much warm air coming in. Of a cold morning say that here is the humidifier; the weaver that works just here (*indicating*) is constantly complaining over the draught; it will send them into the shivers because it is so cold, and the weaver cannot get enough heat on to heat it; but worse than that they have actually put a pipe outside that patent and are introducing live steam to go in with the air to get the heat, but they cannot get it.

6681. Is that in the early morning?—Yes, that is in winter time on cold frosty mornings.

6682. As the day goes on will it get better?—It will get better as the air gets warmer.

6683. That rather points to the fact that the radiating pipes are not heated early enough in the morn-

ing. Later on in the day does it get more comfortable?—Yes, it will get more comfortable as the day gets warmer.

6684. Tell us about the steaming. What opinion have you formed about the health and the comfort of the workers? Which is the more comfortable, the dry shed or the wet shed?—I think if I had my own choice of which I would sooner work in I should take the dry shed; because I do not think we need any steam at all in that place where I work at; it is 100's, 90's, 80's, 70's, 60's, and it is very seldom that you get below 50's. I do not see how it needs a lot of wet steam.

6685. You would be without it if you could?—If I could get to be without it.

6686. I daresay you are quite right; but people who know nothing about it are going to read this report, so tell us why. They want the opinion of a practical man?—My own conviction is that if we were without it I should not be so done up at night when I come out of the mill as I am constantly. This warm air and the steam coming on top of it makes you always seem to be done up in your legs.

6687. You think that where you are working in a steaming shed you are more tired at the end of the day?—Yes, when I have done a day's work I am not fit to go footballing or cricketing; I want to go to bed, and I do not want my tea; but if I play a day I can go home and have my tea.

6688. Do you think it is worse in winter or summer?—I should think it is worse in summer.

6689. We have had some very hot days this year?—Yes.

6690. What was your feeling on those very hot days?—Done up.

6691. Was it anything exceptional? Everybody feels more or less done up on a very hot day, but really did it amount to anything serious, did you feel exceedingly tired?—I do not say that I was ill. I can only say when I come out at night I am tired, and I do not want to do anything else. When you come home you are satisfied with your day's work.

6692. Is it very much worse on hot days than other days?—I should say so from my own opinion.

6693. I suppose you are a piece-worker?—Yes.

6694. Supposing you did away with humidity in the place where you are working now do you think your wages would be as good at the end of the week?—I should think so, but I could not say under the patent that we have, because when yon humidifier is bringing the dry air in it will dry the strings; if you have six or seven or up to ten shafts turning the web out, the air coming in will dry those strings, and you have not your strings as they should be; they are constantly too high.

6695. You are speaking of Hart's system?—Yes.

6696. There is a drum and there are little jets where the cold air comes in?—Yes.

6697. And there is steam coming up?—Yes.

6698. If the steam and the air are on together it ought not to dry up your warp?—I thought you asked me this question: take Hart's patent out, and take all the steaming out, I think we could just earn as much money at yon place without steam as we can with it, but not with yon patent in. If they take steam out and let warm air come it will make it weave a lot worse.

6699. (Mr. Roberts.) In other words, if the steam were done away with and the ventilation were continued you would have bad weaving?—Under Hart's, if it will keep bringing this air in.

6700. Your meaning is that without steam and with the plenum system of ventilation they could not weave?—I mean to say if you take yon out it will weave all right.

6701. That is doing away with the air and everything?—If yon air has to come in the same as it does cold and hot it shows at once it will dry, and they will have to put moisture in to make it weave.

6702. (Professor Lorrain Smith.) When speaking of the ventilators you said that they introduced too much cold air or too much warm air. I did not quite follow

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what you meant by saying too much warm air?—Only take last week, which was a hot week, in the morning they put you this cold part on; that is to say, warm air when you go in at six o'clock, and by breakfast time it will get up to 74°. We cannot do with that. Supposing they had not to put it on, you would have the weavers complaining round this place that they cannot stand the coldness of it. You fancy a fellow or a woman sweating; the thermometer in the shade will be 72° to 73°, and there is coming on to them this cold air. Some can stand it; some cannot. The system we have causes too much grievance. From those in the middle of the shed 30 or 40 yards off you would not hear a complaint as regards this air whether cold or warm, because it does not touch them right away.

6703. It was the statement about too much warm air that I did not follow. By warm air you mean they are putting live steam into the air that is coming in?—They have this to warm the air as it is coming in, and it throws it out warm.

6704. Do they object to the warm air?—Yes.

6705. Why?—You could not satisfy the weavers that work round this fan of Hart's. Whatever you do you have grumblers on one side about one system and grumblers about the other system. You have two sets of weavers, and they are both contrary.

6706. (Mr. Hartley.) I want to get one or two answers from you. You say that if the warm air is not brought in or is stopped, and cold air is brought in it is too dry?—Yes, it will dry our strings up.

6707. Have you noticed the effect on the warps when they are bringing this dry air in?—No, I do not know that I could say I have noticed that.

6708. Does it weave worse or better?—It always throws your strings wrong, d'ye see.

6709. I know what you mean by that, but have you noticed the effect on the yarn apart from the strings?—At the present time I do not think you can tell with ours hardly. Take the same as I have to-day, we have 300 twist, where do we need steam?

6710. (Mr. Shackleton.) You mean three looms?—Three looms of 100 twist. We do not need steam at our place.

6711. (Mr. Hartley.) Can you weave as well without steam as with it?—I could weave you.

6712. But, generally, can you weave as well without steam as with it, and having this air coming in that

you speak of?—There is a class of goods that I could not speak of, that is heavy-sized goods, because I have never woven them.

6713. But your own class of goods?—Yes, I could.

6714. With you air coming in?—Not round about you patent, but in the middle of the shed they could.

6715. You are saying now that the air coming in does make them weave worse?—Round about you patent, but I would not say as it would towards the middle of the shed.

6716. (Mr. Shackleton.) You really mean to say that the yarns you work are from 50s. to 100s.?—Yes.

6717. They are mainly handkerchief cloths?—Yes.

6718. You say with those goods you do not need any steam?—We do not need it, and from my own conviction I think I could manage without steam.

6719. (Mr. Hartley.) You told us in the beginning of your evidence that you made dobbie dhooties at one time without steaming?—Yes, that was the beginning of my weaving.

6720. You were weaving those dobbie dhooties, you say, without steam in the shed?—I should think I were, but to refer back thirty years I am not going to be responsible for my evidence.

6721. You have already told us that you wove dobbie dhooties when you started, that there was no steam, and that they wove all right?—I think they did when I worked at —'s at the start from my experience of the weaving.

6722. Do you know whether they were heavily sized or not at that time when they had no steam in the place?—But you are going a long way back—thirty years—when I was a lad of twelve years that had had no experience of weaving.

6723. You have already told us that they wove well?—What I should call weaving well when I was learning. There were very little ends to take up on that work. I take up more ends now with steam than I did then.

6724. You knew nothing about sizing at that time?—No, and it is a long way back to refer my memory. As far as regards Hart's patent, I should like any of you gentlemen to come some frosty morning; I work for a good master, and gets more comfortable treatment than some, but I think I could make you come outside smartly if I put you under the draught from it.

The witness withdrew.

Mr. H— T—, called and examined.

6725. (Chairman.) You are a weaver?—Yes.

6726. Who was it told you to come here?—I got a note.

6727. From the Weavers' Association?—No, from the Home Office.

6728. Then that is from the Secretary of this Committee. How long have you been a weaver?—Twenty-eight years.

6729. Will you tell us as well as you can remember what mills you have worked in, and tell us if they were dry sheds or if they were wet sheds?—For twenty-one years I worked in dry sheds. In August, 1901, I commenced to work where I am working now, that is where there was steaming.

6730. How long were you in a dry shed?—Twenty-one years.

6731. You left the dry sheds and went to—where?—Does it matter for the name of the firm?

6732. You had better give it?—

6733. (Mr. Hartley.) Are you there now?—Yes.

6734. (Chairman.) What class of goods did you manufacture in the dry sheds where you worked first?—Pretty much the same as we do where I am working now.

6735. (Mr. Shackleton.) What they call Burnley printers?—Yes, what they call Burnley printers; they were not strong goods.

6736. (Mr. Hartley.) Where did you work for twenty-one years?—Say, four places altogether.

6737. All Burnley printers?—Yes.

6738. What class of goods do you manufacture now?—Just ordinary Burnley printers, just sized sufficient to carry the yarns through the healds and reeds.

6739. What system of humidifying have you in your present place?—During the recent boom, employment was good to get, and persons were giving over in large numbers. Mr. — asked them why they were leaving, and they said "bad work." He asked me into the office, and he asked me why they were giving over, and I told him without beating about the bush it was because there was an opportunity of getting a place where there was no steam. We went into the question thoroughly on the representations I made. I daresay he did not wish to lose all his old hands, and he forthwith withdrew the steam, and it has never been in since.

6740. What method of steaming had you when they were using it?—Warm moist air; that is, there was

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water in the pipes, and air was sent over it mixed with steam. I cannot say a single word as to the manner in which it was supervised. It was splendidly supervised. It was a man's constant duty to take the readings of the wet and dry thermometers, and I always said it was as near the minimum amount of steam they possibly could put in. When I went I had no experience whatever in regard to working in a humidified atmosphere; but I found this my experience, that after work had ceased at night I felt rather clammy; I seemed to have sweated or perspired a little bit more in the daytime than I had done before.

6741. (*Chairman.*) That was when the steam was on?—Yes, and when I got into the colder air outside condensation took place, and I felt rather clammy. Of course, the position to me was this: the few shillings extra that I was receiving through working at —'s made a lot of difference in our household arrangements; it was simply a case of making it more advantageous to me.

6742. You are not having any steam now?—No.

6743. Are you making as much wages as you made before when there was steam?—You see things have varied so much. For instance, I have been at —'s since 1901 until now, that is seven years. During that time there has been one boom period; another period when things were not so very good, and things are in a bad way just at present. Of course, for, say, a couple of months or so there was a certain class of yarn to be woven which had already been bought, and until that was got through I daresay that the total net wages would be rather decreased from what they were when we got a different class of yarn.

6744. Are you working full time now?—No, we are stopped Saturdays.

6745. What is your working day?—Monday, Tuesday, Wednesday, Thursday and Friday.

6746. Compare the working day when you had steam and the working day when you had not steam, if you can, with the same class of goods, what is the difference in wages?—Of course, there is a lot in the ability of the weaver; for instance, you get certain cloths in, and you know how long it takes you to weave a certain length, and personally myself I do not know that I have noticed very much difference between when steam was in and the present time, that is, to myself it has not made any difference.

6747. Perhaps you are an exceptionally good weaver?—I do not want to say that. I do not want to let that be conveyed to your mind. I am an average weaver that goes there for what I can get, and I work when I am there.

6748. We do not want to take one individual; we want to take the average number of weavers, and I want to get at this—I will try to put it as plainly as I can. Take a day or two days, or three whole days—I do not care whether one, two, three or four days or a week when you had steam, and now when you have not steam, do the weavers get as much wages?—Unhesitatingly, I should say they do; I should say the total wage list will be quite as big as it was when the steam was in.

6749. Then do you think it weaves as well without steam as with the steam?—Yes.

6750. Is it the same class of yarn?—I could not say for that; they do not take me into their confidence.

6751. Take the warp: as far as you can judge is it the same kind of warp as you had when were steaming?—Yes, but the orders are what you might call repeat orders time after time. We are working goods at the present time that they worked ten years ago.

6752. And as far as you can tell it is the same weft?—Yes.

6753. What about the breakages: is there more piecing now that you have not the steam than there was before: is the work harder?—That is where the whole thing centres to me. I have given much thought to it and studied it without steam and with steam. Steam is not put in for any benefit, only it will give a little more stretching power to the yarn we have to deal with, so that the threads will come through with less breakages. I maintained on the morning that I interviewed Mr. — that the capital

spent in humidifying if spent in another direction, more attention paid in the taping room and in the size box, would bring about as good a result as the result going on as they were doing, and spending all that money in humidifying.

6754. Your argument is that money spent in steaming might be put into better yarn and into improved methods of sizing—is that what you mean?—Yes.

6755. Assume that you have the same material to work on, is the work harder with the steam or without it?—I do not find any difference. Since I got this note I took some particular notice. During this last week I have not noticed any appreciable difference between what it was formerly with steam and what it is now. Of course, more attention has been paid to the size box and the taping, and things are made as fairly decent as they possibly can be for us.

6756. You told us about your health, that you think you suffer less discomfort and work with less exertion in a dry shed?—Yes. When I went at first I had to take great care; that is, I did not leave anything to chance; during the winter months I always wore a Cardigan jacket and a muffler on leaving the mill.

6757. (*Mr. Shackleton.*) I should like just to get a definite answer from you with regard to one question put by the Chairman about working harder. You say it does not make much difference in the result as to the wages?—No.

6758. Do you work harder for the same wages that you got before?—No, I do not think we do.

6759. You gave us an interesting statement as to what happened when Mr. — sent for you, and as a result of that interview the steam was stopped. Then I think you said something about that for two or three weeks just immediately after the stopping of the steam the work was worse?—Yes.

6760. Do I gather from that that after you got those beams out and what was ready in the taping room things began to mend again?—Yes, after we got through what was in stock, say, up to Christmas.

6761. When was it you went to Mr. —?—September 26th was the date of the interview I had with Mr. — I remember very well. In December my wife was ill and I was off my work one Saturday morning. I saw Mr. —, junior, at night, and he told me that the weavers had been up for bad work. I do not see where that bears upon it, for this reason: I went to my work the following Monday, and this was the cause of the bad work: they were putting a sort in which had to be woven with a very fine reed. Those reeds had been hung in the top of the warehouse, and the water boiler was close to, and the reeds had rusted. Speaking generally, I should say that for a month or six weeks, no longer than that, after we had got through the warps we had in, and after what there was in stock upstairs, things began to mend.

6762. Do I gather from what you say that if steaming is stopped at this mill or at any other, with your experience in Burnley printers in two or three months they could have things as they were before as far as wages are concerned?—So far as Burnley printers are concerned steaming is not necessary at all.

6763. You do admit that immediately steam is taken off with the particular sizing you have on it will weave worse?—Yes. Of course, you have to take this into consideration too: Mr. — confessed that the taping was done according to the conditions required in the shed with the humidifier in.

6764. (*Mr. Hartley.*) You say immediately after you stopped humidifying the weaving was worse?—Yes.

6765. But that gradually improved by the introduction of better yarns, that is your point?—Yes.

(*Chairman.*) And a different method of sizing.

(*Mr. Roberts.*) That he does not know.

(*Chairman.*) He expressed some opinion about it.

6766. (*Mr. Shackleton.*) Do you clearly recollect Mr. — saying that the sizing had, of course, been done to meet the steaming in the shed?—I should not say that. I was in the office an hour and a half.

6767. He conveyed that to you?—Yes. For instance, I can demonstrate that to you. Of course, I have

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been to the night school and I understand a little bit of chemistry. What they want in a warp is to get it through, so that it will retain sufficient moistness to have some elasticity and get it through without breaking. For instance, water will freeze; glycerine will not. I know this, that in one experiment that was made glycerine was added because it would not freeze. I will say this, that Mr. — did all that he possibly could to get over the difficulty as quickly as possible; but I think I am right when I say that he conveyed that impression to my mind, that the sizing and taping was done according to the conditions in the shed where the goods were woven.

6768. (Mr. Hartley.) But, taking the conditions as they were in September, 1906, when you stopped steaming, would you say that your wages would be reduced by 3d. per loom per week?—If I had been thinking that the question would have been asked I could have proved it, because I have all my wages down at home.

6769. Would that be a fair statement to say that your wage would suffer 3d. per loom per week?—I do not think it would.

6770. Understand that the conditions are the same, the same warp and the same everything; by the absence of steam would your wages drop 3d. a loom a week?—I should not say they would.

6771. How much should you say?—I should not say anything. There is just another point comes in—

6772. Let me put it another way. You admit the yarn weaves worse?—Yes.

6773. You have more breakages?—Yes.

6774. Hence you must have lessened production?—In the few weeks intervening.

6775. I am asking you if the conditions remained the same as they were when you stopped steaming?—That is with the same class of material put in as we had when steaming?

6776. Yes.—Then I should say wages would drop.

6777. How much?—As a practical manufacturer you know they vary.

6778. Would you say 3d.?—Yes, we will say 3d.

6779. (Mr. Roberts.) Supposing you were to put in humidity now; supposing Mr. — were to commence humidification again, how much would your wages go up, do you think?—I do not think they would go up any.

6780. Your breakages would be fewer. If they were fewer you would be bound to get more money at the

week-end?—I maintain this: it may be a technical point—for instance, the class of goods we have in now weave fairly well, and with the addition of steam I do not think that breakages would be very much less.

6781. You are a student in chemistry?—Yes.

6782. You know very well as a chemist and with your study of that subject, because probably it has been with regard to cotton, that moisture in the atmosphere will improve the weaving of the cotton thread?—Yes.

6783. Therefore of necessity it would reduce the number of breakages in your warp?—Yes.

6784. Of necessity also you must receive more wages at the week-end?—Yes.

6785. Therefore, if they were to put in steam again now you would get better wages at the week-end?—I do not see where the thing that you wish me to say comes in. If there is a certain class of material put in which will weave under any circumstances the mere addition of steam will not make the breakages so much less that there will be a gain of wages involved.

6786. (Mr. Shackleton.) How many looms have you?—Six.

6787. Your statement really is that at the present time you have not many breakages?—No, we are doing very well. Of course, I have a tenter. There is one thing I would like to say by your permission.

(Chairman.) Go on, please.—This humidifier which we have in, I have never seen one like it. The air is driven in with a fan. There is a large trunk comes from off the box where the fan works, that is from off the main trunk, and pipes are thrown through the shed at the present time, and we are using it for ventilation purposes.

6788. Without humidity?—Without humidity, and it is a great benefit to the weavers.

6789. Do you get any draught from it?—No, there is no draught. Of course, it is broken up into so many vent places. I should think there will be 500 vents in the pipes.

6790. That is ventilation without draught?—Yes, and that is true ventilation.

6791. (Mr. Hartley.) Is that your experience? Have you had it working in cold weather?—Yes.

6792. No draughts?—No draughts in cold weather.

6793. Is the air warm?—Yes, there is a nest of pipes or a box of pipes, the air is drawn through them, and it is heated.

The witness withdrew.

Mr. J— K—, called and examined.

6794. (Chairman.) You are a weaver?—Yes.

6795. How long have you been a weaver?—I was an apprentice up to being eighteen years of age. At that time I left and went into the weaving trade, and I am 44 years of age now.

6796. That is 26 years. Have you worked both in dry sheds and humid sheds?—Yes.

6797. Can you tell us as far as your memory goes how long you have worked in dry sheds and how long in wet sheds?—At the first onset I went into a dry shed after leaving the baking trade, and I worked, I should say, four years in a dry shed. After that I went into a shed where they had humidity, and worked there twelve years.

6798. (Mr. Roberts.) And after that?—For the remainder I have been in dry sheds since.

6799. (Chairman.) You are now working in a dry shed?—I am working in a dry shed at the present day.

6800. I will ask you about wages afterwards. I want to ask you now a question or two so far as your health and your comfort are concerned. Which is more comfortable, a dry shed or a wet shed?—A dry shed by far as regards me.

6801. Did you work on the same class of goods in the dry shed and in the wet sheds or were they different classes of goods?—It was mixed goods in the wet shed, and in the dry shed it has all been plain work, but we had a mixed trade, coloured, dobbies, jeanettes, and sateens.

6802. Are the prices the same for both classes of goods?—No, the coloured list is rather higher. I am working in a grey place at present.

6803. We cannot very well compare the wages then. But you say you feel more comfortable?—Yes, in the dry shed.

6804. Do you think if you had a little steam that you would be able to make more wages where you are now?—No, we have a very good class of work where I work, and we make very good money.

6805. Steaming would not help you at all?—No, I do not think it would; the material is good, and I do not think it requires any steam.

6806. At the places where you worked where they had steam, did you think it required it there, did you think it was necessary to have steam there?—No, I do not think it was.

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6807. Was the warp as good as where you are working now, and the yarn?—At the first onset it was very good, but there was an inferior class of work; when they put in steam they lowered the standard of work; that is what I contend.

6808. Why did they do that—I could not say exactly unless it be to make more profits.

6809. Do you think that the class of goods they put in took more piecing, was that it?—I look at it in this way from a personal standpoint, that the steam put in will work an inferior class of material; you have to make this inferior class of material equally as good as the place we are at now where they do not use it.

6810. Your contention is that in order to work the class of yarn they had there they had to put steam in?—Yes.

6811. Otherwise there would have been a great deal of breakages?—Yes, under that class of yarn they were working.

6812. And I suppose the cloth that it turned out was not as good as the cloth where they did not use steam?—Personally I think it could not be. The appearance might look as well.

6813. Are you in favour of doing away with steam?—Yes, strongly in favour.

6814. Would you go as far as to do away with it right through the trade?—Yes.

6815. Everywhere?—Yes, I would totally abolish it.

6816. What about the inferior class of cloth; how would that be made without the steam?—I could not say. I look at it in this way: at one time it was made without steam in Burnley. I take it they would have to go back to the old system. If they put the class of work in you can make it.

6817. Just let us, for the sake of argument, put it in this way: You know there are a great many people over the world weaving?—Yes.

6818. There are some in India and some in America, and, in fact, pretty well all over the world they are weaving?—Yes.

6819. Supposing that we in Lancashire did away with steaming, would not it stop the making of certain kinds of cloth?—Probably it would to-day now.

6820. Would not the foreigner get that?—Yes.

6821. You read the papers, I daresay?—Yes.

6822. And reports. If anybody said to you that steaming is used all over the world would it astonish you to hear it?—I cannot say that it would exactly, because I have heard; and I have come across a man that has been in other countries and worked under it; but they seem to have a different system from what we in Lancashire have.

6823. I think it will be admitted that it is used very largely in the United States?—Yes.

6824. That it is used very largely in India, France, and Belgium. Why do you think these manufacturers use it, why should they take the trouble to put in all this plant unless it was some good for weaving?—I have never given it any particular serious thought, only so far as this: that I contend that they do it because they can work at a cheaper rate than others. The place where I work at we do not use any steam; any steam that comes there comes through the pipes; it is dry, and we get on very well. We make a good average with it, and we have never played a day through all this depression. We have only played at the times agreed by the Masters' Association, a week at Whit-week and two weeks at the fair.

6825. (Mr. Thomas.) You say that you worked four years at a dry shed at the commencement of your weaving career?—Yes.

6826. What sort of health have you had?—My health was normal up to being 26 years of age; I had no medical attendance.

6827. How long had you worked in the steaming shed then?—Just over three years.

6828. Then you had to go under the doctor—what for?—I had quinsy, the first attack when I had any medical attendance; and then after that I got back to work, and I had not been working a week when I fell down ill again. I was down with rheumatic

fever. The feelings that I experienced were these: of course, I did not feel ill all at once, but when I got home at night I had a shivering sensation and felt completely spent. I used to sit down many a time without having any tea, I would rather have a sleep without any tea. I have had seventeen winters in succession down with rheumatism. I never was what you might fairly call well again after working under steam.

6829. How long is it since you worked under steam?—It is getting on for twelve years.

6830. How have you felt since?—I am not as bad as I used to be, but it is there all the same. I have the rheumatic.

6831. Have you ever had quinsy again?—No.

6832. Rheumatic?—Rheumatic fever twice.

6833. But since you left steaming have you had quinsy?—No.

6834. Have you had rheumatic fever?—Not since I left steaming.

6835. Have you been under a doctor since you left steaming?—Yes.

6836. What for?—Rheumatism.

6837. And rheumatic fever?—No.

6838. What sort of health have you now?—Not very good; I have a bad heart.

6839. Have you ever consulted a medical man with regard to what you should do, and what has brought this illness about?—I have been under several medical men. I have not had a big lot of advice, only that I should have to take things quietly. The man I am under to-day looks at it in this way: I am getting my children up, and he says, "You will have a better chance now."

6840. What made you work all this length of time under steaming when it was so injurious to you?—I looked at it in this way: at that time the — was a very good place. I had six looms there. I never had been out of work. Before I left a place I had another to go to. Six looms is not a thing you can get any day. I went never thinking that I should be constantly down with rheumatic.

6841. Supposing you had a chance of working at —'s with a 7s. average, would you prefer to work there rather than where you are now with a 6s. average?—No, I would sooner have the 6s. and not have steaming. But I do not see why I should forfeit it.

6842. If you had an opportunity of going to work at —'s at 7s. a loom average, would you prefer going to work there to your present position with 6s. average?—I do not see why in any case there should be such a thing at all. We have a standard rate of wages.

6843. You do not follow me. If — are making 7s. of an average?—I see it now.

6844. We are speaking about the steaming shop. If you had a chance of having six looms at — and an average of, say, 7s., would you go there in preference to stopping where you are where you are having only 6s. a loom?—I would stop where I am; but I was looking at it in another light.

6845. (Mr. Hartley.) You mean by that answer you would sacrifice 6s. a week rather than be weaving under steaming conditions?—Yes, freely.

6846. (Mr. Roberts.) At the place where you weave now have you any fans or ventilation in the place?—Yes, we have fans bringing in air.

6847. What place is it?— —'s; they put them in last back end.

(Mr. Hartley.) They are plenum fans.

6848. (Mr. Roberts.) Do you like them?—I do not know that I have felt any difference personally. There are two within a very short distance of me.

6849. You have no complaint as to draught?—No.

6850. You have not heard of any complaints?—Yes, I have heard a woman. I have a daughter that works under one. It is between the two women, her and the one abeam of her. I have heard the other one complain, but this girl of mine does not say anything about it.

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6851. Are they working all the winter?—No, the straps were taken off during the winter months.

6852. When were the straps put on again?—When it began to be warm.

6853. About June?—Yes.

6854. (*Mr. Hartley.*) Are you satisfied that if these fans were run in the winter time there would be complaints about draughts?—I fancy there would be from what I have heard: I have not felt any personally.

6855. (*Mr. Roberts.*) Do they stop up the holes, the ducts, with paper or anything during the winter time?—There is a kind of lid on these, and they can be closed.

6856. (*Chairman.*) But when the air came in in winter time was it warmed air or was it cold air?—It is common sense if you blow a gale of wind on a man's head he will stop up everything—I have a box over my head. This is to let air in under the old system of ventilation; but I can close this in cold weather; with pulling the string it closes the lid. I can close it any time I like.

6857. (*Mr. Roberts.*) In winter time you have no ventilation?—Practically no ventilation that I can see.

6858. (*Mr. Hartley.*) In winter time, when you have the fans stopped and all those ventilators closed does the air ever feel oppressive to you?—No, I cannot say that it does.

6859. Not even when the gas is burning?—If we have been lit up a long time on a dark day it begins to be a bit oppressive before we stop.

The witness withdrew.

Mr. W— C—, called and examined.

6872. (*Chairman.*) You are a weaver?—Yes.

6873. How long have you been a weaver?—About 26 years.

6874. Out of the 26 years how many years have you worked in a dry shed and how many in a humid shed?—I have worked where there has been excessive steam about three years.

6875. We do not know what you mean by "excessive." We shall have to ask you that later; but answer my question first, and we will give you an opportunity of explaining that after. How many years have you worked in a shed where there is humidity and in one where there is no humidity?—Where there is steam and where there is no steam?

6876. Yes. I have worked three years where there is steam, and I have worked a portion of the other where there has been just moderate steaming.

6877. We will give you an opportunity of explaining it all afterwards, but just tell us how many years have you worked in a wet shed and how many in a dry shed?—Twenty-five years in one and twelve months in the other.

6878. Twenty-five years in a wet shed?—Yes.

6879. I gather from the remark you made just now that in the wet sheds the amount of steam let in has been variable?—Yes.

6880. And some you describe as excessive? Just tell us what you mean by excessive steaming?—Where there has been plenty of jets blowing off; where they have had plenty of steam in.

6881. How would you describe what is not excessive?—Where they had not so very much.

6882. In a lesser degree, you mean?—Yes, where they have less jets blowing off—a less number of jets.

6883. So far as your comfort and health are concerned is the difference appreciable between the two classes of places that you have described?—Yes.

6884. What is the difference so far as your health and comfort are concerned?—Where they have excessive steam, where they have plenty of jets blowing off you feel it of a morning on your chest, and you spit a lot, and you go home at night with a very clammy feeling; your clothes stick to your back, and when you get home you feel starved.

6860. Except on very dark days towards the end of the day you never feel any inconvenience by the air being foul?—No.

6861. (*Chairman.*) Are they gas jets?—Incandescent.

6862. (*Mr. Hartley.*) Going back to steaming. Is it your opinion that the only use of steam is to enable manufacturers to use a lower class of material?—That is my honest opinion, and I look upon it as a system of torture and slow murder.

6863. You have had no experience at all, I gather, except in Burnley?—No.

6864. I should think you know in Burnley there are no heavy sizing cloths made at all?—No.

6865. The cloths made in Burnley are entirely for bleaching or printing?—That is so.

6866. So there is no weighting material used in the size at all?—No.

6867. You know nothing at all about the Blackburn trade?—No, not in the least.

6868. You know nothing about the shirtings' trade, where the goods are exported in the grey state and have to be sized to a certain weight?—No.

6869. You would qualify your answer perhaps a bit if it were to be applied to shirtings with regard to the use of steam?—I might; I am not prepared to say with not having worked this class of goods.

6870. You would admit it might be useful where they are sizing for weight?—Yes.

6871. Apart from quality of material or anything else?—Yes, it might be in that respect.

6885. Tell us what the effect would be where there is only a little steam?—You do not feel it so bad as all that. Where there is little steaming it is a lot more comfortable during the daytime; you do not feel done up of a night the same. You do not feel as tired at half-past five. Where there is excessive steaming you feel very tired towards three o'clock or half-past.

6886. In which of the two classes of places that you have described, where there is "excessive" steaming and where there is—perhaps we may use the word "moderate" steaming, is the weaving the better?—That question would not be fair from my point, because they had better material where they had very little steam used. The material was a lot better, and I could earn more money where there was moderate steaming than the other sort, because the material was better.

6887. By using what you have termed excessive steaming it was possible to weave inferior yarn?—They had to put steam in to make the yarn weave.

6888. On account of the great many breakages, I suppose?—Yes, that is so.

6889. You have told us you have worked in a dry shed for some time?—Yes, eleven months now.

6890. Will you tell us, does your health suffer in the dry shed?—No, I have never ailed nothing since I went, and I have not been going to a doctor since I went there.

6891. How long have you been in a dry shed now?—About eleven months, I could not tell you the month—ten or eleven months.

6892. When you were working in the place where there was moderate steaming, did your health suffer?—Not so much as it did in the other place.

6893. Did it suffer at all?—I was under the doctor about five or six times during the twenty-five years, that is all.

6894. That is in the moderate steaming?—Yes.

6895. I will ask you about the excessive steaming afterwards. I ask you now about what you describe as moderate steaming. How long were you at that place?—Twenty-five years in a moderate steaming.

6896. (*Professor Lorrain Smith.*) That is the whole time?—No, I said 26 years altogether. I was in the other about three years; so it will be about 22 years

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6897. (*Chairman.*) Twenty-two years in what you call moderate steaming?—Yes.

6898. How many times were you under a doctor in the 22 years?—I had him in the last three or four years most.

6899. How many times were you under the doctor in the 22 years?—It is a long time to go back, is 22 years.

6900. Tell us as far as you can. We most of us remember when we were ill?—If you were to take me back five years I could perhaps tell you all the times.

6901. (*Professor Lorrain Smith.*) I think you said five or six altogether?—That is as far as I can remember.

6902. How many of those were during the period of twenty-two years—was it half of them?—I should say about four times in the 22 years.

6903. What were you suffering from?—Mostly on my chest, bronchitis and that sort of thing.

6904. Bronchial troubles?—Spitting in the morning, coughing before breakfast, mostly.

6905. (*Chairman.*) Did you suffer any bodily inconvenience; I mean did you feel very tired after your work or did you feel pretty well at the end of a day's work?—Do you mean now?

6906. No, I am talking of the time when you were working in the moderate steaming?—I did not feel so bad then as I did in the wet shed.

6907. It was a wet shed, I understand?—Only moderately wet.

6908. Let us hear about what you call the excessive steaming; you described that as where there were a great number more steam jets?—Yes.

6909. What are your feelings in there?—Your clothes feel clammy and stick to you when you go home at night, and when you sit down you go into a cold chill over you. That is the feeling I have had mostly.

6910. Is it worse in the hot weather or in the cold weather?—It is worse in cold weather; I always used to find it so when you went out at night in a cold wind.

6911. How about the very hot days? Take a very hot day: was the exertion much greater than on a winter day or a cool day?—You feel it partly every day; about half-past three you feel tired and done up.

6912. You have worked in a dry shed and in a wet shed?—Yes.

6913. And on hot days in both, I suppose?—Yes, I have worked this summer in a dry shed; this is my first summer.

6914. You have had some very hot days?—Yes.

6915. And you have had some very hot days in a wet shed?—Yes.

6916. Tell us which is more tiring to work in on a hot day?—I should say a wet shed myself.

6917. Are you quite sure of that?—Yes, I am.

6918. Is the exertion greater in the wet shed?—I would not like to say, because it is a different class of goods where I work now in the dry shed—a different class of goods altogether—a coarser weave, and you have to work a little harder to keep up with it, of course. It is not the same; you cannot compare the two you see.

6919. You know that a great many people in Lancashire are working in wet sheds?—Yes.

6920. Supposing that you were to do away with the humidity, do you think that they would suffer in wages?—They might for a beginning until the masters

get it going properly, because there would be a big variation.

6921. You know, as probably most other weavers know, that there has been a proposal that the State should step in and abolish steaming?—Yes.

6922. What do you think of that?—Taking it from my experience of working in a dry shed at the present time, we have work that we can weave without steaming, and I cannot see why they cannot make them all weave without steam.

6923. Have you ever read anything about what goes on in other countries?—Not very much.

6924. Do you know whether they use steam in America?—No, I cannot tell you.

6925. Do you know if they use it in India?—No.

6926. Do you know if they use it in France and Belgium?—I could not tell you that.

6927. You do not know?—No.

6928. If anybody told you that they use it very largely in all those countries how would you account for it?—I could not say. I cannot answer that question.

6929. Would you say it was because they use inferior yarn?—I cannot answer that.

6930. At any rate probably you would think that before our Government should go as far as to say there is to be no steaming, they should consider what is being done in other countries, or whether it would mean any loss of trade to Lancashire?—Yes.

6931. Of course, everybody, I take it, that has anything to do with legislation would wish to do everything that can be done for the health and comfort of the worker; but we must also consider whether he is going to suffer in his pocket. That is a consideration that cannot be put on one side altogether.

6932. (*Mr. Roberts.*) In what town do you work?—

6933. Is it in — where you work that they had excessive steaming as you term it?—Yes.

6934. And where they had ordinary steaming?—Yes.

6935. What is the name of the firm?—You will not bring my name into this?

6936. We are not publishing the names?—Where there has been excessive steaming and where there is at the present time is at —; and where it was moderate at the —.

6937. (*Mr. Wilson.*) Do you know the names of the firms?—(*Names given.*)

6938. (*Mr. Roberts.*) Which is the place where there is excessive steaming?— —, —.

6939. It is twelve months ago, you say?—Since I left the moderate steaming. It will be twenty-two years since I left the excessive steaming. I have worked in moderate steaming twenty-two years.

(*Mr. Roberts.*) There can be no such thing as excessive steaming now, because they must work within the Act.

6940. (*Mr. Hartley.*) Let us be clear. You worked at the place where they steamed moderately for twenty-two years?—Yes.

6941. You left there about four years ago?—No, I left there about twelve months ago.

6942. Where did you get the excessive steaming?—At —.

6943. That is twenty-two years ago. What age were you then?—About twenty-three.

6944. (*Mr. Shackleton.*) What is the name of the dry shed?— —.

The witness withdrew.

Mr. R— P—, called and examined.

6945. (*Chairman.*) How long have you been a weaver?—About 36 years.

6946. You have worked in dry sheds and wet sheds?—I have worked in both.

6947. Can you tell us how long in each?—I worked in one shed where there was no steam I should think about 12 months, and for 20 years odd I worked in one where steam was used.

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6948. Is it all in the same shed or different sheds?—Different sheds. Twenty-one or 22 years in one shed.

6949. Has the amount of steam that has been introduced been pretty much the same right through all the time or has it varied?—Very little; pretty much the same.

6950. What method of introducing steam have you: is it by steam jets?—By steam jets.

6951. Have you had any experience of where it is sent in by trunks right along the room mixed with air?—No.

6952. You do not know anything about that?—No.

6953. When I asked you if it varied, I mean it will vary from day to day according to the atmosphere?—Yes.

6954. Given the same condition of the atmosphere the same amount of steam would be introduced?—That is so.

6955. What conclusions have you arrived at with regard to steaming so far as health and comfort of the workers is concerned?—I will speak according to my opinion. During the 12 months where I have worked where there was no steam my health was good. When I came to work where they had steam my health began to fail and I was subject to rheumatism.

6956. Have you been under many doctors or any?—One.

6957. Can you tell us how long you have been off work in 21 years that you have worked in the wet shed?—I have not been off for sickness above three weeks on and off.

6958. What was the nature of the sickness?—Rheumatism.

6959. (*Professor Lorrain Smith.*) Had you rheumatic fever?—No, I only had rheumatism in my arms.

6959a. Pains?—Yes.

6960. (*Chairman.*) You were off about three weeks?—About three weeks.

6961. About your comfort at work: what time of the year are you most comfortable?—I should think first thing in the morning when you get to your work and the air is pure, then, of course, you feel the benefit of it. As soon as you get to your work the steam begins to be infused, and you feel it gradually coming on. When it comes to the time for the taking of the schedule they begin to take the steam off.

6962. What time is that?—About seven o'clock: that is the time when the schedule is supposed to be taken—between seven and eight. After breakfast time they begin to infuse steam again—excessive steam I call it.

6963. You mean that they begin to take it off a bit before the readings—is it so?—Yes.

6964. Before each of the three readings. They take three readings in the day?—Yes. Then after breakfast time they commence again to turn it on. Perhaps they may turn it off again about ten o'clock. Then it comes on again after dinner. It is very seldom they ever have steam in the whole of the day. They generally have it on and off just as the warps are beginning to get a little damp. The weavers themselves in some cases turn the steam on and off. So soon as they feel the warps get a little bit damp they turn it off.

6965. The weavers turn it on sometimes themselves?—Yes, in some cases; not regularly, but in some cases they do it themselves.

6966. What do they do it for?—To dampen the warps.

6967. But what is the good of damping the warps?—On account of the dryness of them.

6968. How would you get on without the steam then?—The only way that I can suggest is by giving them different material.

6969. (*Professor Lorrain Smith.*) That material will not work without the steam?—Bad material will not work without the steam.

6970. The material you refer to will not work without steam?—No.

6971. (*Chairman.*) If they were to do away with steaming altogether they would have to use a different class of materials in your works?—Yes.

6972. You tell us you have been ill about three weeks?—Yes.

6973. What time of the year do you feel it most comfortable? I do not mean what time of the day, but what time of the year; is it winter, summer or spring?—Although the heat of the shed is very great we feel better in summer time than even we do in winter, because in winter they have even more steam used than in summer.

6974. And so you feel worse in winter?—We feel worse in winter time on account of steam being infused. Our clothes are hanging against the wall, and you are getting damp also yourself when you go out in cold air; you feel the chill after.

6975. In the summer time do not you sweat?—Yes, but there is not the same breeze outside that there is in winter.

6976. On a very hot day you would sweat, and your clothes would get wet underneath?—Yes.

6977. When you went out you would not feel it as much because the contrast between the outside and the inside would not be so great?—That is so.

6978. Which do you feel most tired in, summer or winter?—There is very little to choose so far as that is concerned. As a rule in summer time you are more apt to feel tired on account of the hot weather than you are in winter time.

6979. How many looms do you look after?—Four.

6980. Supposing the class of goods were the same, would your wages suffer now if they took off the steam?—Some portion of the weavers would suffer and some would not.

6981. Who are the ones that would suffer?—As a rule those that are put against the wall side are the persons which get the most brittle work, on account of it being close to the wall the warps have a tendency to dry. As soon as the steam begins to be infused the wall sides will get it before the rest of the shed.

6982. Why should it be drier next the wall side?—On account of the ventilators being near to the walls. When the steam is infused into the shed the dampness will travel, but it will not travel farther than the walls, and it will settle on the walls.

6983. You told us something just now about the clothes getting wet, and clothes being hung up against the wall, I think; have you no cloak room?—No.

6984. Would it be an advantage to the workers to have a cloak room?—I have no doubt it would if the cloak room were protected.

6985. In what way protected?—Some people, the females, leave their frocks and things outside in a cloak room, and perhaps some of them might have their purses in, and that is a thing to be looked at. If the cloak room were protected against anybody being allowed to go in to interfere with the pockets it would be a very good thing.

6986. You do not mean workers, you mean outsiders?—There have been cases I could quote—one case where they have a cloak room, where there seems to have been a certain amount of suspicion even in that case against their own workpeople.

6987. Do you think there would be any way of making a place inside the shed as near as possible for hanging up the clothes?—That would be a good idea.

6988. What sort of things would you suggest?—I think there ought to be some kind of place where it could be heated, so that the clothes would be nice when you came to put them on.

6989. Inside the sheds?—Not exactly inside the shed, but just outside so that it would lead from the shed into the cloak room or into the place where the clothes were hung.

6990. In some places they say there is no room to put up a cloak room. Supposing for the sake of argument there was no room, what would you suggest as

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being a good thing for hanging up the clothes inside the shed itself?—That is a very awkward question.

6991. You see, it is very awkward for us. All you gentlemen are calling out for more comfortable conditions. We want you to tell us what you would do if you were Home Secretary or a member of the Government?—We have hooks against the wall, but it is awkward to suggest something outside where the employer cannot find sufficient accommodation. It does rest mostly with the employer.

6992. I am saying inside the shed?—I cannot speak so far as my own place is concerned, because there is no room.

6993. Would there be any room along the walls?—It

is possible there might be some room alongside the wall, but that would only be narrow.

6994. I suppose the walls are pretty damp?—Yes.

6995. Supposing there were some match-boarding to keep the damp off or some partitions put along?—I have no doubt that would be a very good idea.

6996. (*Professor Lorrain Smith.*) You have not really had very much illness?—No, not very much.

6997. One day a year you have been off work?—I have had one very bad do, and have been subject to rheumatism.

6998. So what you complain of chiefly is being tired at night?—Yes, that is so, a dull feeling.

The witness withdrew.

Mr. M— I—, called and examined.

6999. (*Chairman.*) You are a weaver?—Yes.

7000. How long have you been a weaver?—Over 30 years.

7001. Have you worked in dry and in wet sheds?—Yes.

7002. Which do you like the best?—Dry.

7003. (*Mr. Shackleton.*) In what district are you?—

7004. (*Chairman.*) Can you tell us how long you have been in dry sheds and how long in wet sheds?—I have been working now ten years on the 1st of last April in a wet shed. Previous to that I followed my occupation as a fustian weaver where there is no humidity used. Since then I have been a calico weaver.

7005. Then the last ten years you have been in a wet shed?—Yes.

7006. You told us before you liked the dry shed best?—Yes, most certainly.

7007. Why?—Because I believe in my own mind that it is more beneficial to health to work in a dry atmosphere than it is to work in a wet one.

7008. You think it is better for your health?—Yes.

7009. Which is the more tiring, the wet or the dry?—The wet.

7010. You are sure of that?—Most certainly.

7011. What sort of health have you enjoyed all this time?—Until quite recently, perhaps this last eighteen months, I have enjoyed what you may term fair health. I have had a little illness, but it has been neglect as much as anything else. I have never had a serious illness in my life, but until eighteen months ago I was very subject to chills and cold. I told the doctor last January the conditions I worked under. He told me I was subject to rheumatism, and he told me to get to work in a dry atmosphere. He said working in a humid atmosphere was not suited to my constitution.

7012. Were you able to follow his advice?—No.

7013. You are working in a wet shed?—Yes.

7014. You have worked in it ten years?—Yes.

7015. Can you tell us how many days off you have had for illness?—I have never tabulated them. I could not say from memory how many days I have lost in the last few years. You may put it on an average about seven or eight days a year. I have worked many a time when I have not been in a fit condition to work; but when you have a lot of little children dependent upon you you have to work.

7016. Have they always been the same kind of symptoms?—Colds, and influenza colds, as they term them, you know.

7017. What system of humidifying have they?—The wet system, live steam blowing out of a jet all over the shed. I should say we have between 40 and 50 jets. The holding capacity of the shed is 773 looms.

7018. What class of goods are you working on?—Mostly twills, not very heavy size, I should say; perhaps about 20 per cent. is the extreme.

7019. If they did away with the humidity in that shed what would the effect on weaving be?—The effect on the weaving would be that it would be much harder for the weavers, and the material would not work as well as it does when it is moist. They would have to improve the material to a certain extent if they wanted the same amount of production and I think the weavers would have recompense both from health and improved material. In my opinion, if steaming were abolished the workers would benefit, and the material would benefit by it.

7020. Suppose that they worked with the same material; say, for the sake of argument, that they did not improve the material but worked with the same material, would it make a difference in the weavers' wages?—Certainly.

7021. How much a week?—One really could not say.

7022. What would you think?—There is much depends on a man's qualifications, and how he is engaged, because some people are under-worked, and some are slightly over-worked.

7023. The work would be much harder?—Yes, but there are people that can run three or four looms, and perhaps they are a loom short of what the full measure is; the natural consequence would be that take the humidity out of the shed, the conditions they are working under being so much freer and sweeter, even though they had to work a loom harder, it would not be as exhausting to them in my opinion.

7024. But it would be harder work?—I do not see as it would.

7025. Would not there be more piecing to do?—You would have more work to do in a sense, but it would not be harder, you would not feel the strain the same.

7026. Would you like to work under those conditions?—I should much prefer them to these.

7027. You would prefer to do more piecing or to have more piecing to do, but without humidity?—Yes. Of course you cannot always have your own way, but if I could have my own way I should have the jets turned off round about me.

7028. Who has the control of the jets?—The manager.

7029. Do the workers ever touch them?—They do if they have the opportunity.

7030. What do they do to them?—Some turn them off, and some turn them on. They very often will turn them on.

7031. What do the ones who turn them on turn them on for?—Those are the people who have the opinion that it is an impossibility to weave without steam. There are people that steam does not touch to the extent that it touches others, and they are willing to use it.

7032. Some of the weavers think there is no possibility of weaving without steam?—There are a few.

7033. Where are they?—There is one or two without a doubt.

7034. Have you known different methods of humidifying?—I have only worked under one before, and it

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was only for a day. I cannot give much explanation of the method.

7035. (*Mr. Thomas.*) Does the work at your mill get so bad that the weavers think that they can work better with the steam than they can without it?—They think they can work better. There are times which occur—take the supposition when it is a windy day—that is the time when the weavers ask for steam, and will have it if they could only get it.

7036. Why do they ask for it?—Simply because the material is so bad; that is why they ask for it.

7037. That makes it weave better?—It does make it weave better.

7038. Do you think it is more disagreeable to have steam in than to be without it?—Most certainly I think it is more disagreeable to have steam in.

7039. You put up with the disagreeableness rather than have the bad work?—I would not.

7040. Is that the opinion of some weavers?—Some few.

7041. That is the class of people you talk about when you say they want it?—Those are the weavers that are holding such as me back that are going for improved conditions in the atmosphere of the shed.

7042. You would like to be without it altogether?—I would like to be without it altogether whatever the consequences would be.

7043. (*Mr. Roberts.*) What is the weaving in your shed?—It is neither good nor bad.

7044. To-day?—To-day we have a medium class of material, what you may term a rough class.

7045. You are doing well according to the place to-day?—Certainly.

7046. (*Mr. Shackleton.*) What sort of goods are they?—They are what they term common twills, mostly in the home trade; they are not heavy sized trade or first class trade.

7047. (*Mr. Roberts.*) Supposing to-morrow you have a strong wind, what then?—I am a six-loom weaver, but I should be lucky if I could keep five looms running altogether.

7048. If they were to turn steam out you could not weave at all in a sense?—In a sense, if they were to turn the steam off.

7049. (*Chairman.*) Does not the direction of the wind come in?—There are winds that do not affect the warp when there is a sufficient amount of moisture.

7050. (*Mr. Roberts.*) Take a strong east or north wind?—A strong east wind would play the little devil as they say.

7051. The same warps would be in to-morrow as are in to-day, so that the work would not have gone any worse to-morrow?—It would not have gone any better.

7052. It would not have gone any worse, and it is doing fairly well to-day?—Yes.

7053. Simply by a change of wind it begins to do badly, and then you require artificial moisture to make it weave, do not you?—Yes, and then when we have artificial moisture in, and we are working in a shed which is damp black, a shed which we can never keep clean, which is an inch or an inch and a half thick with refuse that accumulates all the time, and with the stench and smell that arises off there. I consider it is not beneficial to health to work under conditions of that description.

7054. Does that condition obtain in your shed?—Most certainly; it obtains everywhere where there is steam.

7055. Excuse me, you do not know that. You know what your own shed is?—And I know from my visitations to the other sheds.

7056. You say your own shed is an inch to an inch and a half deep in mud?—Yes.

7057. (*Mr. Thomas.*) What do you mean by the term "mud"?—I mean stuff that drops off the looms, the size and stuff.

7058. (*Chairman.*) Just think about that, because an inch and a half is very big. Would not you like

to correct that statement?—I do not say it is all over the shed that depth.

7059. What do you mean?—Round about the boilers.

7060. (*Mr. Thomas.*) Do you mean it is stuff under the loom?—Yes.

7061. Not on the alley ways?—Not where the people walk, but underneath the loom where the moisture congregates more than anywhere else.

7062. Do they ever scrape under the looms here or have they ever done—I mean the floor?—Only the weavers.

7063. Have the weavers scraped under the looms?—Sometimes they have when they have been waiting for warps. They have scraped the floors. The management has on two or three occasions had the by-ways and alleys and approaches all cleared out of dirt.

7064. (*Mr. Hartley.*) Do you think that manufacturers could do without steaming altogether?—Do I think they could do without?

7065. Yes?—Not if they weave the same class of material—no.

7066. Do you think that they would be able to do without steaming if they were to improve the class of material?—Most certainly.

7067. Then I take it your object is to compel manufacturers to use a better class of cotton, a better class of material, if you abolish steaming—that is your object?—My object is primarily solely to abolish steaming; and then I say the force of circumstances would compel employers if they wanted the same amount of production out to improve the material to a certain extent.

7068. You admit that the result would be that the manufacturers would have to buy a better class of material altogether if steaming were abolished?—No, my object is to abolish steaming.

7069. I do not know whether you caught my question. You think that manufacturers would be compelled to buy a better class of material if steaming were abolished?—I think so. I say they would have to do if they wanted the same amount of production; but if they were satisfied with the production they would get with the same class of material they have in now, of course, they would be satisfied. That is all I can say.

7070. What are the counts of twist you use?—Ranging from 30s. to 36s.

7071. (*Mr. Roberts.*) What reed?—About 66, 68 and 70 mostly.

7072. (*Mr. Hartley.*) You have never considered, I suppose, what difference it would make in the demand for these better qualities of cotton if steaming were abolished?—No.

7073. You do not know then that it is not possible to get that class of cotton to supply Lancashire?—It is possible to keep one class by itself, and not let it down with another, which they do do.

7074. There is not enough of the best grades of cotton to go round if you are going to abolish steaming; that is my point. What would you do then?—I should have to let things go as they would go. I say this: that before you should let a thing exist that is detrimental to public health, let it go. Something else would take its place.

7075. How do you know it is detrimental to public health?—From opinion formed not as a student of medicine or anything of that description, but from opinion formed on observations made. I find young persons that come to work perhaps at 15 or 16 or 17 years of age in a shed; when they have worked in a shed perhaps three or four years you see them under the doctor, and the next thing you see is someone carrying one of those big stillages to walk on to keep moisture from the feet. I have found it out from my own personal feelings when I have gone home at night, when I have been fatigued and languid. But when it has been dry under foot on a dry and sunny day when the atmosphere has been practically dry and there has been no humidity at all in the atmosphere I have felt that I have not done a day's work in comparison with when I work in a wet atmosphere.

7076. You are making speeches; you are not answering questions. I want to know these cases where you

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have found injury to health result from steaming—can you tell us any?—I have quoted my own case where the doctor says if I would take his advice I would get out of the trade.

7077. Can you give us any case of these young people you were talking about, being in a shed at about 15 or 16 years of age: can you tell us anybody who has suffered by reason of steaming?—Yes.

7078. Give us names of people?—I can give you one in particular. But it may be if you were to approach them they would not tell you. This is the way we are situated. If you approached them it may be they would not give you the same amount of evidence that you can get second hand. They seem to be a bit afraid of coming forward or a bit lax at coming forward, and I am not going to pledge anyone's name without their full authority.

(Mr. Hartley.) I think the statement this witness makes about the filthy condition of the shed should be tested. I do not believe there is such a place in Lancashire.

(Mr. Roberts.) I think we ought to have the name of the shed, not necessarily for publication, but for our own use as a Committee.

The witness withdrew.

Mr. J—R—, called and examined.

7083. (Chairman.) Are you a weaver now?—Yes.

7084. How long have you been a weaver?—Fourteen years.

7085. In wet sheds or dry sheds?—Wet sheds.

7086. Have you worked somewhere else before?—Yes.

7087. In a dye-house?—Yes.

7088. I suppose you had a good deal of steam in the dye-house?—Yes, it was all steam in the dye-house.

7089. How did that affect your health in the dye-house?—Of course, I was in a drying room; I was not exactly in the dye-house; I was on what they commonly called cylinders—the tins—the drying process.

7090. A sort of calender?—Yes; there was very little steam up there; it was all drying out.

7091. And you worked fourteen years in a wet shed?—Yes.

7092. You might tell us the name of the mill where you worked?—

7093. What class of goods did you manufacture?—Commonly called Burnley goods.

7094. (Mr. Shackleton.) Printers?—Yes, all printers.

7095. (Chairman.) What method have they got for introducing the steam into your shed?—We have got what is commonly called Roger Pye's, a kind of huge tin or cylinder that goes right through the mill. In my opinion it is one of the best methods that we can get. It is one of the best methods I think as far as regards steaming; but still we condemn steam at all times from a working man's point of view.

7096. You do not like it at all?—Not at all.

7097. If you have to have it you would rather have it in that form than in live jets?—Yes.

7098. What sort of health have you enjoyed since you have been working in your present occupation?—I have had snatches of rheumatism. When I have seen the doctor he has said, "If you take my advice you will get out of it and get some other occupation; get outside; it will do you more good."

7099. (Professor Lorrain Smith.) Not work under cover at all?—Not to work under cover at all.

7100. (Chairman.) You have worked there for how many years?—Fourteen.

7101. How many days have you been off?—I have never been off my work at all. I have never been so ill that I have had to stop at home.

7102. You have told us you do not like steaming?—Yes.

7103. Tell us why you do not like it?—Because I consider that it is injurious to health.

7079. (Chairman.) What is the name of the shed?—

7080. (Mr. Hartley.) The — shed at —?— I do not say it is any worse than in any other town. On a very wet day when the water lodges in pools over the shed. It is a shed that has a very bad roof on.

7081. (Professor Lorrain Smith.) The water comes through the roof?—Yes.

(Mr. Roberts.) That has nothing to do with artificial humidity.

(Chairman.) Is it condensation?

(Mr. Roberts.) It is a leaky roof.

(Professor Lorrain Smith.) And rather low humidity in spite of it.

7082. (Mr. Cross.) If steaming were taken away altogether and it would drop you 2s. a week in wages and increase the work would you still be opposed to steaming?—Most certainly. I am willing to have my wages reduced and have a little more extra work if I can have better conditions of employment for the time being.

7104. Take your own case. You say you have not been off for a day in the whole fourteen years?—Yes.

7105. What do you base your opinion upon?—Because I have had doctor's bills to pay though I have never been off, and he contends that it is through the steam that I have had to pay them; and I have a brother that is practically a wreck through the steam. He told him straight if he did not go to a mill where there was no steaming used he would be a complete wreck when he was thirty. He left — and went to a mill where steam was not used, and he has put on between 14 lbs. and 18 lbs. of flesh in eighteen months.

7106. Do you suffer bodily discomfort from the steam—do you find any difference in working where there is steam and where there is not steam?—Yes.

7107. What is the difference?—I do not eat as well; I always feel fagged, always tired; never feel fit to turn out after I have done a day's work.

7108. Is it the same summer and winter?—Just the same.

7109. Which is worse, summer or winter?—Winter.

7110. Why is that?—Because it is damp. In our mill it is damper in winter than it is in summer.

7111. What about the very hot days?—They register something like 86°, but they do not put it on the register 86°; we can see.

7112. That is 86° dry bulb?—Yes, 86° dry bulb, and wet bulb about 72°.

7113. What about it from a different point of view? We will put health on one side for the moment. Does it weave better with the steam or without the steam?—It does not seem to take any effect on our work, not a bit. We have tried it without steam for weeks at once, and it does not seem to affect it at all.

7114. Why did they take it on again?—I suppose some asked for it and he put it in again. I suppose he was not exactly compelled, but if he takes it out for two or three days there are two or three asking him to put steam in, and saying that it weaves better.

7115. Who are they?—Some of the women.

7116. Why do they ask for it?—Because they think it weaves better.

7117. Then there are some weavers that think it weaves better with the steam?—Yes, it softens it or moistens it, I suppose.

7118. Have you ever made any inquiries about what is done in other countries—have you had any opportunity of knowing?—No.

7119. Have you ever heard if they use it in Bombay?—No.

7120. Or in France?—No.

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7121. Or in Germany, and in the United States?—They do not use it in Canada.

7122. Or in Belgium? You say that they do not use it in Canada?—In Montreal they do not use it. One fellow that comes from Burnley says they do not use it in the Valley Field Cotton Company.

7123. Supposing somebody who had studied the question told you that they used steam very largely in all those countries, how would you account for it?—Bad material; an inferior class of stuff. We never used it before. My father has worked at Birch ever since it began about 23 years ago, and for twelve or thirteen years they never had any steam at all.

7124. You would attribute it to inferior stuff?—Yes.

7125. We in this country I suppose must make a lot of inferior stuff?—Of course, every country makes a lot of inferior stuff.

7126. Supposing you were to do away with it altogether that would take away a lot of our trade, would not it?—I do not think so. Personally I would sooner piece a few more threads a day and keep my back bent more than have steam.

7127. You do not think it would interfere with the trade at all?—No, they made this class of goods before steam was introduced and I think they could make them again.

7128. (Mr. Thomas.) Do I understand you to say that you have worked at — the whole time?—I have worked at — practically ever since I learned

to weave; only we had a strike in 1902, then I worked at —. They had no steam at —. I worked at — again in 1905 when we had another strike. Where they have no steam I had more average at that shop than I had at —. I prefer a dry shed.

7129. Although there may be more work and lessened wages?—I do not say there is any lessened wages. They have more wages.

7130. If you had the opportunity of working either in a steaming shed or in a dry shed and the steaming shed was 3d. or 6d. a loom more, which shed would you prefer?—The dry shed.

7131. (Mr. Hartley.) Would you expect that reduction of 6d. a loom to continue from your wages?—No.

7132. But you expect to get back to the same production?—Yes.

7133. You would not be content to go on working at 6d. a loom less?—Yes, I should. I contend that from what you say that I would work a little bit harder in a dry shed than I should in a wet shed to get 6d. a loom more.

7134. I will put it in another way. Do you think that the operatives of Lancashire would be content to have 3d. or 6d. a loom reduced wages by reason of the stoppage of steaming permanently?—Personally I do.

7135. You believe they would?—Yes, I believe they would.

The witness withdrew.

Mr. J— T— B—, called and examined.

7136. (Chairman.) You are a weaver?—Yes.

7137. How long have you been weaving?—Thirty-eight years.

7138. Have you been weaving all that time in humid sheds?—No.

7139. How long in humid sheds?—Twenty years.

7140. Eighteen years in dry sheds?—Yes, or seventeen.

7141. Which do you like the best, the wet or the dry?—The dry.

7142. You like the dry best?—Yes.

7143. Tell us why, will you?—I have worked at the shed I work in at present over a quarter of a century, and the first ten or eleven years it was dry. Since then we have had these artificial humidifiers, and my contention and that of the people I work with is that we were considerably healthier then than what we are now.

7144. The people you used to work with?—Yes. One case in point is a daughter of mine. That girl was taken into the shed at twelve years of age. She was a fine young girl, but she had not been in that shed long before she began to be bothered with rheumatic; and now as a consequence her joints have grown out of shape, both feet and hands. Then another thing is that many a time in the morning when we go to our work we have rheumatic pains; I have myself rheumatic pains in both shoulders and the other joints.

7145. You think that is due to the steaming?—Yes.

7146. How many days have you been off or how many weeks or months have you been off ill since you worked in that shed?—I could not say, but I have been off six weeks and a month at different times.

7147. Have you been on the funds of the Union at all?—No, they do not pay for sickness.

7148. But you have been off sick?—I have been off sick. Of course, we do not pay from our Society.

7149. You attribute it to the moisture, do you?—Yes.

7150. How do they humidify in your shed, have they steam jets?—No, there are two great pipes that run through the shed, and, of course, there are branches in every other alley; and over my head about six yards in length there will be seven outlets;

it may happen three inches and up to four inches and two inches deep.

7151. Are the outlets on the side or on the top?—On the side.

7152. Have you any draughts?—Yes, there is a draught from these articles that they have put in a year or two since that come down like a chimney from the top of the shed. Of course, there is a fan in connection with them, and there is a draught that comes from it.

(Mr. Shackleton.) Is that Hart's machine that they have put in?

7153. (Mr. Roberts.) Do the trunks that come down bend a little?—No, they come direct straight down.

7154. With a fan in the end of it?—There are outlets all round the bottom. There is a fan worked from the shafting inside this trunk, and this air comes out with considerable force.

(Mr. Thomas.) It was given to us as Pye's system.

7155. (Chairman.) How many of those are there in that shed?—I cannot say. I know there is one close beside me. The humidifier is a main pipe that comes down one portion of the shed.

7156. Do you get any draught from the humidifier?—No.

7157. But from this other you do?—Yes.

7158. You think then that the humidity does you harm, or is it the draught, which?—There is steam, and we contend against this system. The feeling is very high on the part of the people that I represent against this system. We contend that these artificial humidifiers cannot moisten the material we have to work with without considerably damping our clothing, and when we go out at night, and particularly in winter time when we leave the shed, of course we begin to feel starved; and, putting it in a humorous way, if you will allow me, to keep warm in the house where there is a good fire, we should have to be hung on a jack, otherwise we are starving on one side and burning to death on the other.

7159. Do not you think the moisture comes from the sweating?—I do not sweat much at my work.

7160. If you were to go and feel the clothing hung up there, do you think it would feel wet?—I mean in your shed?—Yes, cold and damp.

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Mr. J— T— B—.

7161. On a dry day. I am not speaking of clothing when you walk in a shower to the mill, but on a dry day; taking a dry coat and hanging it in the shed, do you think it would get wet?—Yes, it gets to feel damp. You know in a shed such as I work in we generally have our clothes wrong side out so that it does not spoil them and keeps them respectable to work in, and down the sleeves is damp when we put our arms in; very damp sometimes; it depends where the wind is. If the wind is coming in one direction it brings the moisture.

7162. (*Mr. Shackleton.*) You say you have worked in this shed as a dry shed part of the time, have not you?—Yes.

7163. Could you give us an estimate as to the difference in wages between then and now, reckoning, of course, the difference in the advances that have been made since. Do you think you have earned more money as the result of steaming?—No.

7164. You have not earned any more?—No more money now than we were earning prior to that; that is, if we take in proportion.

7165. Have you had a fair run of the same kind of sorts at your place?—Yes.

7166. Could you carry your mind back even in the dry sheds as to whether they were similar kinds of cloth or not?—Yes, the exact sorts I wove there thirty years ago as I am weaving at present.

7167. When you made the change from a dry shed to a wet shed eleven years ago, or whenever it was?—Sixteen years ago, it is.

7168. Then did it put 2s. a week on your wages?—No.

7169. You did not get 6d. a loom more then?—No.

7170. So your idea is that you will not get 6d. a loom less if it goes back?—I am certain we shall not get 6d. a loom less: I will tell you why. Directly we enter into a shed this weather we seem to lose all energy, consequently we are not in a position to follow the machinery as we were when the atmosphere in the shed felt so much clearer.

7171. You are not getting any more wages for the work done, except the advances, and you are not in as good health as the result of your work?—That is what I mean. We are not in as good health, and wages are no more than they were then.

7172. You sum up the whole situation by saying you are better off in health without steam?—Yes.

7173. And your wages would not suffer?—Yes.

7174. (*Mr. Hartley.*) This firm manufactures printers?—Yes.

7175. Light printing cloths?—Yes.

7176. They are all sized to weave?—Yes.

7177. You say your production is no greater now than it was before the introduction of steam?—Yes.

7178. Is your machinery modern?—Well, some of it is modern. The looms that I work on now have been running thirty years.

7179. Have they gone appreciably worse the last sixteen years?—They are bound to go worse.

7180. (*Mr. Shackleton.*) Is your speed less?—They keep mounting them up.

7181. Is your speed less?—No, the speed is a bit greater than it was, I dare say.

7182. (*Mr. Hartley.*) You would not say that —'s would have much difficulty in doing without steam?—I do not think they would have any difficulty whatever.

7183. You have no experience of heavy sizing?—Yes, I have woven heavy sized goods.

7184. Supposing they were heavily sized how would they be affected by doing away with steam?—I do not know particularly how they would be affected. I have not woven heavy sized goods of late years.

7185. They would feel the changes in the atmosphere more?—Yes.

7186. A great deal?—I am not prepared to say how much; but I am prepared to acknowledge this: that in a dry wind all these cotton threads are more brittle. But there is no necessity for them being that way providing the sizing was mixed to suit the material. Here we have a firm just across from ours, Haslams, a big firm. They are not bothered with steam in their weaving sheds, and there they earn considerably more money than we do.

7187. Are you earning less money because you steam them?—We have not the same quality of material, and as a consequence it cannot be kept going.

7188. (*Mr. Shackleton.*) Do —'s make similar goods to you?—They make a heavier class, a better class of goods, but you see it is the cotton.

7189. (*Mr. Thomas.*) I should like to put one question. I do not know whether it is in order, but I think it is very material. Do you think that they use steam purposely so that they can use an inferior quality of yarn?—That is my firm conviction. I believe if there was a better quality of yarn they would not need these artificial humidifiers, and it would stand the strain of any atmosphere I should think better than what it would with the class that we have to use.

The witness withdrew.

Mr. H— H— called and examined.

7190. (*Chairman.*) You are a weaver?—Yes.

7191. How long have you worked as a weaver?—Thirty-seven years.

7192. Did you work as anything before?—No.

7193. You began life as a weaver or as a tenter?—Yes.

7194. Have you worked in dry sheds and in wet sheds?—Both.

7195. Have you made the same class of goods in dry sheds and in wet sheds?—No.

7196. Tell us the class of goods you made in the dry sheds?—Sateens, and it will be 25 years since I made Orleans, as we used to call them.

7197. For how long have you been working in a wet shed?—Fifteen years.

7198. (*Mr. Shackleton.*) Where did you work at in a dry shed?— —'s.

7199. (*Chairman.*) You have worked 15 years in a wet shed?—Yes.

7200. In the same place all the time?—Yes.

7201. What system of humidity have you?—It is Shaw's.

7202. You have also fans?—Yes.

7203. A thing coming down from the roof and pipes for the steam?—Yes.

7204. I suppose the steam and the air come in through holes in those pipes?—Yes.

7205. In addition to that you have this sending in of cold air?—Yes.

7206. Is it cold air or is it sometimes hot air?—I have felt several times and can never tell much difference.

7207. In winter do they warm the air that comes through that sort of trunks?—It is supposed to be warm, but I have never taken the trouble to feel at them.

7208. That being so, I took it that they have not troubled you very much?—You can feel a draught from them—a very cold draught sometimes; it all depends where you work. You might work near one of them and if you worked two or three alleys off you would not feel it.

7209. When do you feel the draught most, summer or winter?—Where I work the different winds will affect different parts in the shed.

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7210. An east wind is a cold wind?—Yes.

7211. Then the draught coming in is much colder than the air inside?—Yes.

7212. Do you think if they had inside this trunk some hot coils to warm the air when it came in on a cold day it would make it any better?—It would not be a bad thing. When you have a cold draught you have to put extra clothing on.

7213. Which do you think is most likely to do you harm, a cold current of air, or a current of air about the same temperature as the room?—I am sure I could not answer that.

7214. Supposing that this is the middle of winter and we have big fires in here and the thermometer standing at 75° in this room, and that outside it is freezing; supposing I lifted that window up, what would happen?—You would get a cold blast.

7215. Suppose for the sake of argument that you could heat the air outside to 75°, what would happen then?—I should think it would not make much difference.

7216. Supposing it was not 75° and we got it to, say, 60°, then the difference would not be very great?—No.

7217. And you would not feel the same cold chilling effect upon you?—No.

7218. Would not it be the same if you got a cold blast brought into the mill from outside with an east wind until enough air was heated inside—you would feel it?—Yes.

7219. If it was warm would you feel it in the same way?—Supposing that was left to some official to do it. They do not always do what they should do in these cases where steam is used. It is the officials many a time that are wrong there. They do not look after it.

7220. What opinion have you formed about the moisture in your mill?—I do not believe in it. I have two girls that are weavers; I have not taken one to where there is steaming.

7221. Your daughters are not working in a humid shed?—No.

7222. You are?—Yes.

7223. What is your opinion?—I have been laid up with rheumatic since the steaming started—I never had it before—three times in ten years.

7224. How long each time?—I had nine weeks once. I believe it ran about nine or ten weeks each time, and I was off my work.

7225. With the doctor in attendance?—Yes.

7226. What did the doctor tell you you were suffering from?—He said, "You would be better if you worked in a different place." He asked me whether there was steaming where I worked. I said yes. He said, I have no doubt you would do better if you went to another place.

7227. (*Professor Lorrain Smith.*) Were you kept in bed?—I was in bed a certain time.

7228. How long would you be in bed when you were laid up for nine weeks?—A fortnight or three weeks.

7229. (*Chairman.*) Would you like to see that moisture done away with in your shed?—For my own part I would certainly.

7230. Do you think the operatives generally would like to see it done away with?—Honestly speaking I am not going to speak prejudicially for or against it. I do not think the steaming mends the work whether it is in or out. I do not think it makes much difference. I do not think it mends it. If I were a manufacturer I would not use it.

7231. I suppose the manufacturer thinks it does some good or he would not have it there?—I daresay he does, but we are working the cloth; we see it and know whether it does any good at all.

7232. Do the other workers in your shed think it does any good?—I do not know what they think. I know there is a deal of grumbling about it being in. It gives you such a tired feeling.

7233. Supposing it were shut off, do you think any would wish it brought back again?—There are some people that do not know their own minds. I am certain I would not say it. I never have done yet.

7234-5. Do you think you would get the same wages?—My opinion is that they would.

7236. How many looms do you mind?—Six.

7237. Do you think you could mind six looms and get the same wages?—I think so.

7238. Have you ever tried it?—Yes, we have had the steam knocked off many a time, and I do not think that it ever made any difference to my work.

7239. We will suppose that you had a week of cold north-easterly wind, could you knock it off for that week?—I have done.

7240. In north-east winds?—Yes.

7241. Why do they knock it off sometimes?—I could not tell you. It is the indifference of the persons who have to look after it many a time.

7242. Are you able to say it has been really knocked off when there have been north and easterly winds for several days?—That is a thing I have never taken much notice of.

7243. Of course it is in those days when weaving becomes difficult, is not it?—Yes.

7244. Have you really seriously thought of what would happen if it were knocked off, we will say for three or four days, with an easterly wind? Would the work go on properly?—Well, for all the steam that we use I should say it would.

7245. You think it would go on without any steam?—Yes.

7246. Or any moisture?—Yes.

7247. Would they do a bit of degging?—No, if there is anything done we do it ourselves. We put what is called a wet cloth on.

7248. Probably you would in those cases put a wet cloth on?—Yes, but that would not affect us. We put it on the warp. It would only touch the beams.

7249. You think that that would be sufficient, that by putting a wet cloth on the beam behind that would meet those cases?—It would beat 100 steams, would that.

7250. (*Professor Lorrain Smith.*) Have you ever worked in a shed where they humidify by breaking up water?—No, I have only worked in this one place. I do not believe in changing much.

7251. (*Mr. Cross.*) How long have you been of opinion you would like to do without steam?—Ever since it started. I never did care about it at all.

7252. Ever since it was turned from a dry to a wet shed?—Yes, you feel that you have with your clothes a dampness all the time, and when you are going out you get a chill on you.

7253. (*Mr. Hartley.*) You said the doctor told you you would be better not working at this place?—Yes.

7254. Who was your doctor?—Dr. —.

7255. Had he felt your clothes?—No.

7256. Had he noticed they were damp?—No.

7257. Had he been into the shed?—I could not tell you that.

7258. How had he got the impression, do you think, that it was injuring you: would it be through what you told him?—No. I do not know how he got that. He asked me did I work at a place where there was steam. I fancy he thought that a damp atmosphere was against my constitution.

The witness withdrew.

FOURTEENTH DAY.

Tuesday, 3rd November, 1908.

At Manchester.

PRESENT:

COMMANDER SIR HAMILTON FREER-SMITH, R.N. (*Chairman*).

Mr. H. HIGSON.

Mr. T. ROBERTS.

Mr. D. J. SHACKLETON, M.P.

Professor J. LORRAIN SMITH.

Mr. F. THOMAS.

Mr. D. R. WILSON (*Secretary*).

Mr. JOHN TAYLOR, called and examined.

7259. (*Chairman*.) Will you please state what offices you hold?—I am Secretary of the Blackburn and District Cotton Spinners and Manufacturers Association, and Joint Secretary of the North and North-East Lancashire Cotton Spinners and Manufacturers Association.

7260. We know, but we want to have it on the records how long you have been associated with the cotton trade, and what opportunities you have had of forming opinions, not only from a manufacturing but also from a health point of view?—I have been practically connected with the trade all my life, and more particularly during the last 27 years. I have been a mill manager for 10 years, and in 1896 I was appointed Secretary of the North-East Lancashire Association. During that time I have had many opportunities of gaining experience both with regard to ventilation and with regard to humidity, and in the days of Mr. Osborne, when Mr. Osborne was inspector, I was mill manager. I tried many experiments in the way of ventilating the shed where I was employed, and in trying to assist him to find out what was the best thing to be done.

7261. You said you were mill manager; in what year was that?—I commenced in 1896—at least, I came to North-East Lancashire in 1896; I commenced at Riston Mill in January, 1882.

7262. During the time you served as a manager, had you opportunities of seeing dry sheds and also moist sheds—I mean to say, where artificial humidity is produced?—Yes.

7263. You had opportunities?—Yes. In 1891 and 1892 I was President of the Blackburn Managers' Association. We often discussed the systems of ventilation and visited various sheds.

7264. Can you tell us at about what time artificial humidity was first introduced into Lancashire?—In the old hand-loom weaving days. It was introduced then in a very crude form. I have seen it in the outside districts of Blackburn—in the hand-loom districts—where they had a trench dug behind the beam and filled it with water.

7265. That is sometimes called degging, is it?—No, not degging. Where a beam was fixed behind a hand-loom they dug a trench in the floor, and filled it with water.

7266. Can you tell us at what period artificial humidity by steam was introduced into Lancashire?—I can remember it myself back into the Seventies. I cannot say who were the first to begin to use it.

7267. Can you tell us in what district it was used then?—In Blackburn.

7268. In Blackburn it was used in 1870?—Yes.

7269. What was the system then adopted?—That of a small brass tap screwed into the large heating pipes. In the old days we had large cast-iron pipes for heating the sheds. The first system I saw was to have a brass tap screwed into the cast-iron pipe and steam was allowed to blow off—any quantity of it—all over the place. It was a very crude system. That was the first I saw of it.

7270. Was it overhead or where?—About 9 ft. from the floor. The pipes were generally run round a little below the driving shafts.

7271. Have you any knowledge as to when the system of humidifying by atomising water first came into use?—Yes, I think the first system I saw of that kind was Roger Pye's system, and it was introduced at Shaw's in Colne. I believe that was the first he fixed up, and that would be about 1886, I think, or 1887, and then after that followed Parson's system.

7272. Of late years since you have had opportunities of judging of the merits of the two systems, one known as steaming, and the other of introducing water by atomising?—Yes.

7273. From a manufacturing point of view which do you think the better of those two systems?—I think the system of atomising the water.

7274. From a health point of view, which do you think the better?—I think the same.

7275. Will you tell us why?—With the atomising of water I think you can get better distribution; and with the atomising of water you have a plenum system of ventilation. With that system the fans are distributed over the area of the shed, more so than with any other system; and I think you get a purer atmosphere and better distribution of the air, and also better distribution of the humidity.

7276. You are probably aware that there have been complaints as to excessive heat in summer?—Yes.

7277. By which system do you think the shed would be kept cool as far as possible?—By the atomising of water, as in some sheds I have known them put a block of ice into the large zinc cistern where the water is pumped through, and you can get the water very, very cold in that way. By the plenum system of pipes you need not have the fans on the pipes so as to bring cold air in. In the winter time it would be too cold. You would heat the pipes in the coils for the inlet tubes for the fans; you can also heat the water.

7278. You speak of the plenum system of ventilation. Have you heard any complaints from the workers in regard to draughts where the plenum system is introduced?—Not where you have the full plenum system, and properly introduced. In the earlier stages of it when you had a greater number of inlet fans, you had outlet fans, then you had short circuiting, and you created draughts. The first shed fixed up with that kind was Thomas Clayton's, of Langho. There were five inlet fans and four outlet fans. We found it all right there in the summer time. In the winter time cold air was coming in, and came down upon the heads of the operatives, and they objected very strongly to it.

7279. Was it cold air or was the air passed through the heating coil or through the radiator?—There were no heating coils in. That was the first shed fixed up. We had not conceived the idea of putting heating coils in.

7280. Has that idea since been carried out in many works?—Yes, in a large number; in fact I do not know anyone who puts in this system not without putting heating coils in.

Mr. J. TAYLOR.

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7281. Talking of the plenum system, it has been suggested to this Committee that certain objections may be taken to it on the ground that in the summer the air is drawn from close to the top of the shed when the tiles are very hot, and where there is really a layer of heated air, and consequently the air brought in will be unduly heated instead of cold as one would want it: do you think there is anything in that contention?—It might make some slight difference; I think it would only be slight; but certainly if I were putting in an installation I should carry the trunks above the pike of the roof.

7282. Or could the air be drawn from the shade in any way?—I do not see how that could be done.

7283. What would you suggest in order that the air brought in may not be heated above the normal heat of the atmosphere?—I think if you carried the trunk inlet fan, say, a foot to 18 inches above the pike of the roof, it would not get hold of that heated air radiated from the tiles or slates.

7284. You know Hart's system, no doubt?—Yes.

7285. Do you know that the air is supposed to be drawn in through a moist piece of cloth or matting, or something of that sort—in practice has that been generally done where Hart's system is introduced?—No.

7286. Have you any experience as to whether when it is done the air is cooled as it comes in?—I could not speak from practical experience there. I do think it would be a benefit, and in the later installations of Hart's system I know that he has carried a trunk above the pike of the roof, and that he has put a sort of wire netting round it covered over with a sort of cocoanut matting in the summer time, and I do not think it is used in the winter. I do not know of any case where it has been used in the winter time.

7287. (*Professor Lorrain Smith.*) Are there any observations on the benefit arising from getting the inlet high?—I do not think so; not to my knowledge.

7288. You do not know of any temperatures taken?—No, but I think it is only commonsense.

7289. The point is whether it is enough. You said a foot and a-half above the pike?—Yes.

7290. My point was whether you knew that that was enough?—I could not say from practical experience, but I think it is commonsense that if you have a fan and keep the top of it below the pike of the roof as some of them were fixed in the old days, you must have a certain amount of heat arising from the slates there, and the hood which covers over the trunk is bound to collect some of that hot air. However, by carrying out the trunk above the pike, say, a foot to 18 inches, then the current of air which is travelling about on the top of the shed, would be cooler, and I do not think you would get any of this warm air from the roof, or if you did it would be infinitesimal, anyway.

7291. (*Mr. Higson.*) It is always supposing the air is stationary, when you would get hot air from the roof, but a breath of wind seems to move it along.

7292. I think it is possible it might make a slight difference if it was above the pike.

7293. (*Chairman.*) You have heard lately of a ballot of weavers on the question of what is known as steaming?—Yes.

7294. And you are, of course, well aware that there was an overwhelming majority in favour of the abolition of steaming?—Yes.

7295. Now what is your opinion? I ask you as a practical man, do you consider that steaming or the introduction of artificial humidity is necessary for the satisfactory weaving of cloth?—I do.

7296. You consider it is so?—In all classes of goods I am quite certain it is to the benefit of the employer and the workmen.

7297. That is to have artificial humidity in some form?—Yes, in all classes of cottons.

7298. You are aware, of course, that there are a very large number of sheds in which no artificial humidity is introduced?—Yes.

7299. At any rate the proportion is very large. How do you account for the fact that weaving, so far as

can be judged, is satisfactorily carried on in those dry sheds?—I can find a large number of dry sheds where they use fine yarns and fine reeds where it may be satisfactory; but if they used artificial humidity it would be more satisfactory. The cloth would be more satisfactory; there would be less work for the weavers, and they would inhale less dust, and it would be better for their health. I know one shed where they never go below 80 reed, that is very fine; and in fine yarns they introduced artificial humidity, and the production went up very considerably.

7300. Is it a fact that actually the same classes of goods are produced in certain sheds where artificial humidity is used and in others where it is not used?—Yes.

7301. Is it a fact?—Yes.

7302. Are you able to give us any statistics or facts as regards the output of those two classes of sheds?—I could not give you the figures, but I can give you the sheds.

7303. We must not mention the sheds, but you might give them to us for our own information?—There is —, —. They make all very fine reeds and high pick sateens. They use artificial humidity. You will find that — of — make the same class of goods, and they do not use artificial humidity.

7304. But you cannot tell us anything with regard to the output?—No.

7305. Or the wages of the workers?—No. I think you will find there was the same width of loom and the same class of goods in those two sheds; but you will find that there is a better production and better cloth made by — than in the other shed where it is not used.

7306. It has been suggested to us that the reason why weaving is carried on satisfactorily without artificial humidity is that the yarn used is of a much better quality?—I do not believe it for one moment.

7307. You think that the yarn is the same in both?—They use equal qualities of yarn in the two mills, and I will guarantee to produce a greater amount of cloth, and better cloth, where artificial humidity is used from the same spinners' yarn.

7308. Then you do not think that the class of yarn used in dry sheds is better than that generally used in wet sheds?—No, I do not, not for the same class of goods.

7309. Then from your point of view that is not the solution?—No, certainly not.

7310. Now what do you consider to be the most satisfactory condition for satisfactory weaving?—I am talking with regard to the wet and dry bulbs?—You do not want to get below 66° if you want to have satisfactory weaving.

7311. Dry bulb or wet bulb?—Dry bulb.

7312. And the wet bulb?—You want to get 2° to 3° below, that is to say, 63° to 64°.

7313. Then you think you can weave satisfactorily?—You can get very good weaving conditions with those wet and dry bulbs.

7314. 63° wet bulb?—Yes, you never want to get below that. You can get up to 74°; I should prefer to get higher than lower.

7315. Would that apply to all classes of weaving sheds? Of course, I have in my mind places where there is, perhaps, a proportion of over 100 per cent. of size: do you think that weaving would be satisfactorily carried on in those sheds under those conditions?—Yes.

7316. Would you go further and say so if the size went up to 150 per cent.?—If you got over 100 and up to 250 as at Bacup, Haslingden and in the Rochdale district, then you have to use a large amount of antiseptic as softener, and having this in your size you get your weaving conditions from the artificial humidity. If you had no artificial humidity, although you had a large amount of softener in the size, antiseptic and so on, your weaving would not be anything like so satisfactory; you could not get the moisture to go on with.

7317. Do I understand you rightly that you fix the wet bulb reading at 63°?—Yes, not to come below that.

7318. And you think that by using satisfactory sizing weaving could be carried on even where the sizing goes

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up to 150 per cent., we will say, with a wet bulb thermometer of 63°?—Yes.

7319. I understood you to say, Mr. Taylor, that weaving could be satisfactorily carried on from a weaving point of view?—Yes.

7320. Looking at the question from a health point of view, at what wet bulb temperature do you think that the weavers begin to suffer bodily discomfort? The question of health is perhaps very difficult to decide?—I should say when the wet bulb gets much over 70° they might begin to feel it a little bit.

7321. It would begin to be uncomfortable for the weavers?—Possibly so. You get those conditions in the height of summer. Everybody knows when you get to that temperature you get a bit uncomfortable, unless the clothing is adapted for it; and many of the weavers do not change their clothing.

7322. In the report of Sir Henry Roscoe's Committee there was a great deal said about the purity of the moisture introduced into the sheds. That Committee reported that in their opinion probably the impurity of the steam or the moisture introduced had more to do with bad health than the amount of CO₂. Have you considered that question at all?—I do not think there is much in that. Of course, if you take your water from a stream where there is sewage or anything of that kind, you may get something injurious to the health of the workpeople. I remember a case some years ago where an Inspector prosecuted owing to water being taken from the Irwell. In that case it was proved by chemists of high standing—they were not members of ours, and I could not give the firm, and I do not remember who the chemist was that was engaged—there was some chemist of high standing in the matter, and Dr. Barr of Bury was also engaged in it—it was proved that there was nothing at all injurious to the health of the workpeople in the steam which was infused into the shed; therefore the Inspector lost his case.

7323. You are aware that some questions were raised with regard to the water from the canal at Rishton some years ago?—Yes.

7324. And that in consequence of that the Home Office, together with Mr. Scudder, an expert, suggested a standard for the guidance of manufacturers as to what might be used, although that standard has no legal authority?—Yes.

7325. That was, I think, an understanding between the manufacturers and the Home Office?—That came about in this way. The inspector at that time was objecting to various waters, that is, waters from streams out in the country where they had a lodge, and the water was collected from the drains, and so on, and also to canal water and various other waters. We collected at that time a number of samples from Burnley, Blackburn, Rishton, Chorley, and all the length of the canal covered by the members of the North-East Lancashire Association. These samples were analysed by Dr. Pickard of Blackburn, and we afterwards approached the Home Office upon the subject, and they disagreed with the point of where the samples had been collected from; and it was then suggested that the samples should be collected from the hot-well, and I believe Mr. Williams, who was then the inspector, collected a number of samples at various points, and we also collected a number of samples all the way from Nelson to Chorley. These samples were tested, a report was sent to the Home Office, then a standard was fixed. I have not a copy of that with me; I have it at my office—I mean the standard of the purity of the water.

7326. Since that standard was fixed have there been any further complaints, do you know?—I have never heard a single word of complaint anywhere.

7327. That is since that standard was fixed?—No.

7328. Presumably so far it has given satisfaction?—Yes.

7329. With regard to CO₂, Mr. Taylor, you know the present standard of course?—Yes.

7330. It is 9 parts in 10,000?—Yes.

7331. You know that the manufacturers have been put to very considerable expense in putting in plant to maintain that standard?—Yes.

7332. At one time it was asserted that it was a difficult standard to maintain?—That is so.

7333. You remember that there were a good many inquiries by experts and others, and a great many tests taken, not only by the Department but by outside experts?—Yes.

7334. And the conclusion arrived at was that the 9 standard should be maintained?—Yes, it could be obtained and maintained.

7335. And that is now admitted?—Yes.

7336. Will you tell us anything with regard to the cost of maintaining that: is it a serious item?—I should not say so.

7337. We will assume for the sake of argument that the health of the workers would not suffer were the standard raised slightly. By "raised" I mean to say from 9 to 12?—I do not think they would suffer at all—I am quite certain of it.

7338. Would it be any relief to the manufacturer?—It might be some little. On certain dates when you have east winds blowing, and you are taking in a large volume of air, you get the shed cold, and you do not get the same weaving conditions. You are bound to take in 2,000 ft. per operative to obtain that standard of 9. In times of very cold winds and snowstorms, if the inspector came in and we were found to have the figure of 12 or 13 it would mean a prosecution. If it were relaxed somewhat I think it would be both to the benefit of employer and employed, and I am quite certain that the health of the workpeople would not be affected.

7339. Would it tend to reduce the amount of artificial moisture put into the shed?—None whatever; it would not make the slightest difference.

7340. I put it in this way. Supposing there were a strong east wind blowing or there was a very dry air, in order to maintain the 9 standard the air in the room must be changed very frequently?—Yes.

7341. If you are changing the air in the room very frequently, and taking out all the moisture from breath and so on, it is necessary under those conditions to introduce more artificial moisture?—In east winds you require more artificial humidity, it is true.

7342. If the standard were 12 it would not be necessary to introduce as much artificial moisture?—If you go up to 12 you would not need to put the amount of air through, and would not dry the place so much, and you would get a little less humidity in that way.

7343. Have you any experience of dry sheds?—Yes.

7344. You know there is no standard of ventilation in dry sheds?—I do.

7345. Have you any reason to suppose that the workers do suffer in health in consequence?—I have visited sheds where they use all pure size where there is no ventilation, and I have told the employer that if that shed were in Blackburn the workpeople would not stay in. The amount of dust, the blue haze, you could see looking over the looms was shocking. I would not work in that dust.

7346. Your impressions were that it was unhealthy for the workers?—Yes.

7347. That being so would you recommend a standard of ventilation for dry sheds?—With humidity. Taking the class of goods they weave there it would be very difficult to weave them without any humidity.

7348. I have no doubt that later you may perhaps wish to make some statement. I have asked you upon points that strike me. There may be some points that strike you, but in the meantime I daresay some members of the Committee might like to ask you some questions that I omitted?—I do not think I have anything to add.

7349. (*Professor Lorrain Smith.*) Will you define the limit of temperature? You said from 63° to 64° wet bulb up to 74° wet bulb?—Yes.

7350. What do you take into account in defining that limit? I mean on the one hand there is the weaver, and on the other hand there is the production of the cloth. How do you arrive at the limit you have given us?—By practical experience. I find that those tem-

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peratures you get the best weaving and the best production.

7351. Is that because the weaving is better mechanically or is it the comfort of the weaver?—Both the comfort of the weaver, and the yarn weaves better. If you get a shed on a cold winter's morning, say a Monday, the temperature will be down to 55° to 60°, and then the yarn is starved and will not weave; the workpeople feel starved, and they cannot handle it.

7352. Say you had it down to 55° and you had 80 per cent. of humidity, that is, supposing the temperature were at 55° and the mill humidity were 80 it would still weave badly?—It would not weave so well as it would if the temperature were higher.

7353. Is there a corresponding upper limit?—Yes.

7354. You have given us 63° to 64° as the lower limit?—Yes.

7355. The upper limit you gave was 74°?—Yes.

7356. Were you there considering the weaving again or the workers?—I think both. When you get up to 80° the hands of the workpeople begin to perspire, and with the plenum system you are getting an increased amount of humidity from the incoming air and condensation from the incoming air, so they cannot handle the yarn the same with the perspiration on their fingers, especially fine yarns.

7357. Is that 80° wet bulb or dry bulb?—It is practically the same, say 80° on the dry bulb.

7358. Quite apart from the workers the weaving is worse above 74°?—Yes, I should get it down if I could for my own sake as well as for the workpeople.

7359. The comfort of the weavers begins to suffer if you go over 70° wet bulb?—Yes.

7360. You arrive at your limit by taking into consideration both the comfort of the worker and the weaving conditions?—Yes, if you do not give the weavers good conditions, healthy conditions, you will not get good weaving.

7361. (*Mr. Thomas.*) Do I take it you lay more stress on the heat of the shed than on the humidity of the shed for weaving purposes?—No.

7362. (*Chairman.*) Could you give us generally what you think should be done in cases of this sort? What I mean is this. You say down at 55° dry bulb there would not be nice weaving, it would be too cold?—Yes.

7363. And it would not matter what the humidity was?—Yes.

7364. (*Mr. Thomas.*) Then when you get over 70°—I think you said that 74° was perhaps as far as you would like to go—that was as high both from the weaving point of view and the humidity point of view as you would care to have?—Yes.

7365. What I want to find out is this, if you can give it to us—and I think you are a practical man—do you lay more stress on the humidity than you do on the heat?—It is about equal.

7366. I think you will admit that there is more artificial humidity used now in pure size sheds than there was 20 years ago?—Certainly, in all kinds of sheds.

7367. But particularly with regard to pure size sheds there will be more steaming than there was before?—There is in all sheds, and there would be more still if you would allow it to go on.

7368. Prior to the year 1889, when the Act was passed, I think that all heavily sized sheds had some kind of humidity introduced?—No, I do not say so.

7369. Still there has been a large number of sheds where pure sized goods are worked where there has been artificial humidity introduced?—Yes.

7370. During that 20 years have you any information as to whether the complaints from the operatives with regard to the quality of the material have been greater than they were prior to 1889—I mean the complaints of bad work?—There may have been complaints in some seasons when we have had a bad crop of cotton, dirty stuff, sandy cotton, cotton of short staple. Two years ago we had more complaints than ever we have had in any one year previous or since.

7371. Notwithstanding even the steaming conditions?—No matter what you do, if you have a bad

season's crop of cotton you will have some bad work, and especially so at the end of the season. We had more complaints of bad spinning two years ago than we have ever had in any one year.

7372. Whether you use steam or do not you would have those complaints?—If there was a bad season's crop of cotton, certainly.

7373. You also stated that in your opinion the yarns in every place would weave better with steam or with the use of humidity than without it?—Yes.

7374. That is artificial humidity?—Yes.

7375. Can you give us any reason why steaming is not introduced into places where they make coloured goods?—It is introduced into some.

7376. And with success?—Yes.

7377. But the great bulk of the coloured trade is done without artificial humidity?—It is not at Colne.

7378. In Colne, Nelson, and that neighbourhood?—That is so, but in other districts it is.

7379. Yet we do not seem to receive any complaints from the employers with regard to the conditions under which they work in their production?—That may be so.

7380. Coloured goods can be worked without steam?—Yes.

7381. Can you give us any idea why that is so?—Owing to the prejudice of the operatives, they being so dead against steaming. In the old days, when it was blown off into the air from an open pipe, practically filling the place, as I illustrated at the beginning of my remarks, it got the people's back up against steaming, and it has been talked about and talked about, and certain officials have made it a pet theme to talk about, and have got the operatives against it.

7382. You do not catch my point. Employers in the coloured trade tell us they do not require it. What answer can you give to that?—The answer I can give you is this: Those men have not worked in other trades to see the advantage of artificial humidity, but others have since introduced it into coloured weaving sheds. In the Colne district they would all be clamouring to have the same thing.

7383. There is nothing in their contention that they cannot do with steaming, as it would interfere with the colours?—If they are fixed colours there is no trouble whatever. Just as you have in dhooties—if you have aniline dyes for dhooty borders, and you have a large amount of steam, the colour will bleed into the grey yarn, but if you have fast colours you can use as much steam as you like, and there would be no bleeding of that colour into the yarn.

7384. You also stated that in your opinion you do not think that any different quality of yarn is used in steaming sheds compared with dry sheds?—Not for the same class of goods.

7385. Have you found in your experience that the production in a dry shed is worse than in a steaming shed?—Yes.

7386. Would you say so in all cases?—On the same class of goods, yes. I say that I can improve it. I say, as a practical man, that in any shed where there is no artificial humidity used, but the same yarns from the same spinning mill as in another shed where there is artificial humidity used, I will guarantee to increase the production in that shed by introducing artificial humidity, and I will give the workpeople more healthy conditions.

7387. You are fairly well acquainted with the Burnley district?—Yes.

7388. It is looked upon as a pure size place?—Yes.

7389. You understand it is a great producing place?—Yes.

7390. That is, we get almost the highest possible production, yet you say if you introduced artificial humidity you could get an even greater production than that?—Yes, in the sheds where they have no humidity. But there are a large number of sheds in Burnley where they have humidity.

7391. I am speaking now of a very high productive place in Burnley where they do not use steam, and your contention is that if they introduced artificial

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humidity they could get an even greater percentage yet?—I do.

7392. Then if an employer says that it is no benefit to him to introduce steam he is mistaken?—Yes, I am quite certain of it. There are scores of them who do not use it to-day, and do not know the benefit of it.

7393. Leaving that question, suppose we get to the heat of the place, have you ever fixed in your own mind at what heat artificial humidity should cease?—You mean when it should be turned off?

7394. Yes?—When it got over 75° wet bulb.

7395. You think that when it got up to 75° it ought to be stopped?—Yes.

7396. Not before?—Then shut the humidity off.

7397. Not before that?—No.

7398. You also say, I take it from your answer, that you would not like to suggest that there should be any standard of ventilation in dry sheds except there was artificial humidity?—That is so.

7399. You would not like to fix any standard?—No, because there is a very great deal of difference in the dry sheds. You might have a dry shed which was down in a hollow and damp, and you might get there fairly decent weaving. Then you may be making the same class of goods at a great deal higher altitude, and have very bad weaving.

7400. Do you think it is all a question of sizing? What I mean is this. I have in my mind now one employer who has two mills, one is very low down, and the other is very high up. He sizes or tapes the goods, as we call it, differently for both places, and by regulating in that manner he can get off practically the same production from each mill. Do you think there is anything in the contention that if the employers would only tape or size their warps in suitable ways in all pure sized places they could absolutely dispense with artificial humidity?—That is a very big question. I know a shed which is on a sort of sandy land, quick-sandy land, and water, even in the summer time when it is pretty dry, is percolating through the flags, and you have all the shed floor wet without throwing any water on it. Now you may get into another place where the shed is on very dry land. I know a shed where an employer was dead against using humidity, and did not want to use any humidity, and did not want to use any humidity, but I think it was more on account of the expense than anything else. He built a large new shed, and he had all six-inch flags, and set them apart by putting a piece of wood between each flag; then he grouted it with cement. Then he found that he could scarcely weave at all. He had to put in a humidifier, and he has got it in to-day. That is —, at —, now run by —.

7401. You know that a number of mills in Burnley did use steam?—Yes.

7402. And now they have dispensed with it?—Yes.

7403. The average earnings at some of those mills were at a certain figure while they were steaming, and since the abolition of steaming the average, if anything, is a trifle over. Can you give any explanation of that?—Yes, it may be higher reeds and higher picks. They may have changed from American yarns to Egyptian yarns.

7404. But I can give you definite information upon that point. You know that a very large number of employers have what is termed repetition orders?—Quite so.

7405. In the mill that I have in my mind they have a large number of repetition orders, yet the average was slightly better during the time when artificial humidity was not introduced compared with what it was when they had it; have you any solution to give of that?—Yes. That is a very large shed, I expect?

7406. A very large shed?—I expected it would be. When in this large shed you have a great deal of repetition orders you have at certain times of the year repetition orders of 12 by 9, you have also large repetition orders of 13 by 15; and if at the time when they dispensed with artificial humidity they were making cloth 12 by 9, and then they went on to 13

by 15, you know, as a practical man, they would get more money off.

7407. I will put the case straighter than that. I say that the exact repetition order itself is giving better production through the dry shed than it did before?—And exactly the same reed and pick?

7408. Exactly the same reed and pick?—I would like to see it. If you will tell me which mill it is I will get to know. I can get to see it anywhere, and I will give you the information as I get it. I have never seen it in my life, and I would like to see it.

7409. Then, of course, we take it from your practical experience you would not think that was possible?—No.

(Chairman.) We must bear in mind that Mr. Taylor is giving evidence. You say that such a thing is so, and you ought to put it to him in this way: "Assuming it to be so," because you are not giving evidence.

(Mr. Thomas.) I want to put it as fairly as possible. I wanted to get it from Mr. Taylor, because he is an all-round practical man, and perhaps he can give us some solution that he has in his own mind why this is so.

(Chairman.) You may put a case to him, "Supposing it to be so," because as you are not giving evidence we can hardly take statements.

(Professor Lorrain Smith.) Perhaps he might define the time. Mr. Taylor promised to answer the question. Will you, Mr. Thomas, define the time of the year or the period over which it extends?

(Mr. Thomas.) Take the same period of the year.

7410. (Chairman.) Are you able to give us any information from personal inspection or inquiries as to the steaming used in weaving sheds in foreign countries?—Yes. In America, in New Bedford and Fall River, you find that they blow the steam off in much the old-fashioned style that we used to do it in twenty years ago.

7411. Have you seen this?—I have seen it in the mills. In some cases the steam pipe is carried underneath the floor, and there is a small grid where the steam evaporates into the room underneath the beams, and in some cases in the middle of the alley, where the workpeople have to walk over it.

7412. Can you give us any information as to the class of goods being manufactured there?—A great many of them are purely sized. I think we only found one mill, if I remember rightly, where they had heavy sizing. That was at Fall River. They were putting on about 75 per cent. of size, and they were blowing the steam up from the floor, and every crevice that could be made up was made up, so there was no allowing steam to escape at all. In some of the newer mills in New Bedford there was a large new mill where they were putting in a humidifier which was a good deal like the system of Parson's. It was brought with large tubes to the centre of the room, and then branched off in different directions, and there were very large fans about 54 in. diameter driving the air into those tubes and some jets blowing in branch pipes. In the Southern States some of them also had got the ordinary steam jets that we have in Lancashire—just a small steam jet blowing off—one jet to every six or eight looms. I did not count them, but from observation I should say one jet to every six or eight looms.

7413. (Mr. Thomas.) Did you notice the height of the roof in the sheds in America?—Yes.

7414. Do you think they would be much higher than they are in this country?—Some of them. Some of them would be quite as high as our newer sheds, but I do not think any were higher.

7415. (Chairman.) Did you see any non-humid sheds in America—dry sheds?—Yes, we visited one shed in Pawtucket filled with Northrop looms. They were weaving sateens.

7416. Any other dry sheds?—No.

7417. You speak of "we." Who was with you?—A deputation from the North-east Lancashire Manufacturers' Association, along with Mr. Shackleton. Mr. Shackleton went with us.

7418. (Mr. Higson.) You ought to say there are very few sheds in America; they are weaving rooms generally?—Yes, they are in rooms.

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7419. There are very few weaving sheds?—Not sheds in the style we have got them here. The Bourne Mill, with 3,700 Northrop looms, had a boarded floor built upon pillars. All the shafting was underneath.

7420. It had a shed roof?—Yes.

7421. The bulk of the weaving in the States is in rooms?—Like a spinning mill here.

7422. (*Chairman.*) Have you any experience of other countries—France?—No. I have been there, but I have never been in any of the sheds there.

7423. Then you cannot speak of any other countries but America?—I have not visited any sheds in other

countries. I have been in all the other countries at the congresses, but have not been at the sheds.

7424. Is there any statement you would like to make to this Committee?—No, I do not think so. I believe that if humidity were dispensed with it would be to the detriment of the workpeople quite as much as it would be to the detriment of the employers, by reducing production and by the conditions of work, having to breathe dust and small fibres which would be floating about. That condition would be very greatly to their detriment, and the production would be reduced and the quality of the cloth would not be so good, not only in the warp itself, but from the dryness of the atmosphere drying the straps and getting bad driving, and that kind of thing. I do not know that I can say anything further.

The witness withdrew.

Dr. ARTHUR RANSOME, called in and examined.

7425. (*Chairman.*) Will you kindly state your degrees?—I am an M.D., F.R.C.P. and F.R.S.

7426. You were a member of the Home Office Committee presided over by Sir Henry Roscoe, I think?—Yes, with Sir William Roberts.

7427. I think it has been explained to you that after a good many years of work under this Fourth Schedule, in the opinion of the operatives, at any rate, some amendment is necessary; that there was a very large ballot of the weavers taken, and that they were practically unanimous in the opinion that they suffered some considerable discomfort, and furthermore, in the opinion of the weavers, that they suffered in health?—Yes.

7428. Our report will say what conclusions we have come to upon that; but one question that has exercised us a good deal is what was actually running in the mind of the former Committee when this table was drawn up. You see, we find a table here beginning at a dry bulb reading of 35° and finishing at 100°. Of course, it is known to every practical person that weaving could not be carried on at any rate until the dry bulb reading was approximately somewhere about 63° or 64°, I suppose, and that practically it would be impossible for any operative to work in the higher temperatures that are found in the table?—Yes.

7429. I have no doubt you will be able to explain something about what was running in the mind of the former Committee?—That really was drawn up by Sir Henry Roscoe; in the previous schedule in the old Bill of all.

7430. (*Mr. Shackleton.*) The 1889 Bill?—Yes, and I do not know what made them put such a large scale. Of course, I quite agree with you, Mr. Chairman, that many of those figures are useless. They were probably put in for the sake of completeness. The limits of usefulness could not well be fixed.

7431. (*Chairman.*) Coming within practical limits—by “practical” I mean limits usually found in a weaving shed—can you tell us what was the particular evil that this was intended to cure?—I may say the saturation of the air with moisture.

7432. Am I right in supposing that representations were made to the effect that the clothing of the workers became very damp, and that these limits here would prevent the deposit of moisture on the clothing?—Yes, I have no doubt that was the intention. I noticed that Sir Henry Roscoe was very particular in his enquiries as to whether there was any sign of free steam in the sheds. I think the usual answer was “No”; and he was rather pleased, I think, with the result; that schedule having been drawn up on that account.

7433. Various witnesses well known in the scientific world, have suggested to us that the question that exercises our minds most is really the temperature of the wet bulb. Have you formed any opinion as to this: at what wet bulb temperature bodily discomfort is likely to begin, and at what wet bulb temperature would the body temperature begin to rise abnormally?—I do not think I can answer that straight off,

because in this schedule they take care that the dry bulb thermometer shall always be above the wet bulb, and in the higher degrees with the wet bulb thermometer the difference increases so that there was never saturation.

7434. Might we ask your opinion whether it is more important to consider the relative humidity or even the absolute humidity, or whether from a health point of view we should consider the readings of the wet bulb thermometer alone?—I think they are both extremely important as regards a thorough state of health; I think that the readings of both thermometers are of importance, because unquestionably with a high reading of the dry bulb thermometer you can have fairly high readings of the wet bulb thermometer without very obvious injury (I will put it in that way) to health.

7435. But I think you said that you had not, from personal experiments or from personal knowledge, formed any opinion as to at what temperature of the wet bulb bodily suffering would begin and the body temperature would rise?—I am afraid I could not fix a limit. At the same time, I can say in general terms that medical men would certainly consider a high reading of the wet bulb thermometer likely to be detrimental to health.

7436. But you do not fix any particular degree?—No. May I say, Mr. Chairman, that in our observations—I do not know whether you have reached that point or not, or whether it is out of order—but in our conclusions as to the general health of the operatives in the humidified sheds we arrived at the opinion that the health was above the average; but that did not imply that we considered there was no injury whatever to health from the humidity in the shed. It was a question of relative mortality and relative sickness in the two sets of sheds, the wet sheds and the dry sheds. You see what I mean?

7437. Quite so; you are now comparing the artificially humidified sheds with what are known as dry sheds?—Just so. It has really a bearing upon that question.

7438. (*Professor Lorrain Smith.*) What was your conclusion as between the two sheds?—At that time the conclusion was that the health of the operatives was above the average in the humidified sheds.

7439. As compared with the dry sheds?—As compared with the dry sheds—that is the point—only as compared with the dry sheds and the non-ventilated sheds.

7440. (*Mr. Roberts.*) Do we understand that you mean that the wet shed was healthier?—Healthier. I do not say that it was really healthy, but it was healthier.

7441. (*Chairman.*) Will you be good enough to say to what did you attribute this?—We attributed it to the better ventilation of the humidified sheds.

7442. In the Report of Sir Henry Roscoe's Committee considerable stress was laid not only on ventilation, but also on the purity of the water used for steaming purposes. I think the report stated that probably any injury to health in the wet sheds was

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due more to defective ventilation and to impurities than to other causes?—Yes.

7443. Now I think no standard of purity was suggested for the water to be used in the sheds?—No. I think that was a very serious omission. It arose, I can tell you, in this way: We at first proposed that only town's water should be used for the preparation of the steam to be employed in the humidifying; but it was pointed out to us that there was no town's water in many of the places where these sheds existed. Accordingly, I think it was put "As pure water as possible," and there was no standard of purity set up. I saw Sir Henry Roscoe upon that point last night, and he suggested that the word "potable" ought to have been used. That would have secured that the water used should be at any rate pure enough for drinking purposes. He did not see how you could put a fixed standard, but you might put it that it was healthy drinking water.

7444. Potable water?—Potable water.

7445. We understand, then, that Sir Henry Roscoe suggests that the water used should be potable water?—Potable water.

7446. May we take it that you agree in that?—Entirely, and I candidly confess that was an important omission in our report.

7447. The Act reads: "The water used for the purpose of producing humidity shall either be taken from a public supply of drinking water or other source of pure water." Pure water does not exist in nature, I take it?—Yes.

7448. "Or shall be effectively purified to the satisfaction of the inspector." It is very difficult for the inspector?—I also saw Mr. Williams, and he said it was impossible for the inspector to do that.

7449. Questions have arisen in consequence of this, and Mr. Scudder, whom you know was Sir Henry Roscoe's personal assistant, gave some advice, and other technical advice was taken; and there was a temporary arrangement made between the Manufacturers' Association and the Home Office that the water used should come up to a certain standard. We have that standard. "No water shall be used for producing humidity in the air or in wet spinning troughs which is liable to cause injury to the health of persons employed or to yield effluvia, and for the purpose of this regulation any water which absorbs from an acid solution of permanganate of potash in four hours at 60° more than 0.5 grain of oxygen per gallon of water shall be deemed to be liable to cause injury to the health of the persons employed." One can hardly ask you on the spur of the moment to express an opinion upon a question of that sort, but may we ask if you would consider it and give us an opinion?—I think I can give an opinion at once—that so much depends upon the source of the water. If, as we saw at Padiham and at other places, the water was drawn from what was practically a sewer, even if it contained a very small amount of organic impurity, it might produce evil effects, even if somewhat under the standard that has been set there. I say it depends somewhat upon the source.

7450. Of course, we remember that this water is boiled?—Yes, that is what a manager of Padiham Mills said to us: "It doesn't matter, it is boiled"; but the effect upon the senses was very distinct, and we could not wonder that the operatives complained of having no appetite for breakfast and of general ill-health.

7451. (Professor Lorrain Smith.) That would come under the provision about giving off effluvia?—What does it say about effluvia?

7452. (Chairman.) "No water shall be used for producing humidity in the air or in wet spinning troughs"—(that is as put into the Belfast mills)—"which is liable to cause injury to the health of persons employed, or to yield effluvia," and then it says, "and for the purpose of this regulation any water which absorbs from an acid solution of permanganate of potash in four hours at 60° more than 0.5 grain of oxygen per gallon of water shall be deemed to be liable to cause injury to the health of the persons employed."

7453. (Professor Lorrain Smith.) The water you refer to would have been excluded?—Yes, if the inspector could carry that out it is possible there might be no harm arising from it. That is my doubt, as to whether it would be possible for him to decide simply that there was no effluvia that was doing any harm.

7454. The impurities would be carried in the steam in the form of inorganic impurities?—Would they necessarily be inorganic? There might be some organic effluvia which might be carried with the steam.

7455. After condensation?—Which would remain in the condensed vapour; I think it is quite possible; organic ammonias for instance; I think it would be safer to make the regulation that it should be potable water.

7456. The standard of ventilation suggested by the Committee was nine parts of CO₂ in 10,000, I think?—Yes.

7457. That has been carried out as far as possible, with very few exceptions well carried out?—I have no doubt you have had it from Mr. Williams, but Mr. Williams gave me cases in which it has not been carried out; in about one-third of the factories the percentage was more than nine volumes.

7458. When was that?—It appears in the Chief Inspector's reports for 1907, 1906, and 1905. There has been an improvement.

7459. Was there much excess; does Mr. Williams say what excess there was?—It is given on various pages to which he has given me the references in these Chief Inspectors' reports. The analyses were made by Haldane's and Pettenkofer's methods. Most of them were made by Haldane's method.

7460. That is in the Chief Inspectors' Reports?—Yes, for 1905, 1906 and 1907.

7461. (Mr. Roberts.) Were those dry sheds or wet sheds?—All wet sheds, humidified sheds. Shall I give you the numbers he has given me?

7462. (Chairman.) Yes?—In 1905 there were nine volumes in 246 out of 393.

7463. That is the exact limit?—Yes, the percentage in which it was not done was 37 per cent.

7464. (Mr. Shackleton.) The remainder was over nine?—There were nine volumes in 246.

7465. And over nine in the remainder?—Over nine in the remainder. There were 12 volumes or less in 103, 20 volumes or less in 42, and over 20 in two.

7466. Will you give me the page for that?—That is page 250 in the report for 1905. Shall I give you the figures for 1906?

7467. Yes, please?—The page is 178. I am giving you now only Haldane's analyses. There were 642 with 9 volumes; 241 with 12 or less; 119 with 20 or less, and 21 with over 20. The total of that set of analyses was 1,023. In 1907, page 139, in the analyses by Haldane's method there were 849 with 9 volumes or less; 360 with 12 volumes or less; 131 with 20 volumes or less, and 5 with over 20. The total of that set of analyses was 1,345; so that you see, in about one-third of the cases the limit was exceeded.

7468. (Chairman.) The standard of ventilation was fixed at 9, was not it?—Yes.

7469. I think I am right in saying that CO₂ in itself would not be injurious to health at 9 parts in 10,000?—Certainly not.

7470. In fact, if we were simply dealing with CO₂ itself we might allow a very much larger proportion?—Certainly.

7471. Could you say what proportion might be allowed if we were dealing simply with CO₂ itself?—I think Dr. Angus Smith and Dr. Haldane both show that you could go up to enormous amounts. I have forgotten exactly the proportion, but I think it was something like 12 per thousand or 20 per thousand, was it not?

7472. (Professor Lorrain Smith.) One per cent.?—Yes.

7473. (Chairman.) Professor Cadman was giving evidence and showed that probably the average in our English mines was about 34 parts?—Yes.

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7474. And I noticed reading in the "Mining Journal" for last week that there is a new Act for Victoria, and that 25 parts per 10,000 of CO_2 is allowed, which of course goes to show that CO_2 in itself is not injurious?—If it was simply from combustion.

7475. We have taken what is called the CO_2 standard, and I believe the CO_2 standard is a measure of other impurities?—Yes, and I think we made that plain by stating that we only took the measure of the respired impurity when the gas was not lighted.

7476. It is so, that it measures other impurities?—Yes.

7477. Might I ask what are the other impurities that it is a measure of?—Especially the organic matter of the air, of the breath, and of the skin and so on.

7478. That would be moisture and CO_2 given off by the breath of the workers?—Yes.

7479. I think the breath of the workers you consider is highly charged with organic matter?—Yes.*

7480. And you have shown in "Researches on Tuberculosis," page 23, that the vapour from healthy breath contains 3·568 parts per 100,000 of albuminoid ammonia, nearly as much as the Thames sewage at the south outfall?—Yes.

7481. And you have shown in the same research that it is an excellent medium for the cultivation of micro-organisms both putrefactive and pathogenic?—Yes.

7482. I have asked these questions because we have before us certain proposals in regard to the standard of ventilation, and we have before us the fact that in mines where there is a great deal of humidity there is a very high standard allowed; but can we draw any distinction between the CO_2 such as we could find it in weaving sheds and CO_2 such as we would find it in the mines? I mean in mines there are very few workers, they are not close together, and there is a current of air going through, and so on?—There are no lights, I suppose?

7483. There are miners' lamps?—There is very little carbonic acid from combustion.

7484. (Professor Lorrain Smith.) In coal mines you would have the slow combustion of coal?—Yes, so that there would be a certain amount of carbonic acid from that source.

7485. It would depend on what the mine was, I should think?—Yes, I should think so. There must be less importance in the mine than in the weaving shed.

7486. (Chairman.) Then presumably it would not be at all prudent to suggest a standard of ventilation at all approximating to what would be allowed in mines?—I think it would be very dangerous.

7487. (Professor Lorrain Smith.) You do not know of any observations corresponding to those that you have made—analyses of air from mines?—No.

7488. I mean to be compared with your observations on the condensed vapour?—No, the only observations that would in any way compare with them were my own observations upon the ground air in a cellar at Southampton, and in a hole dug in the ground at Bournemouth. By freezing the aqueous vapour I collected a certain amount of fluid from those sources and used it for cultivating microbes and found that they were both excellent media for cultivating microbes.

7489. (Professor Lorrain Smith.) Did you make any observations on the harmful effect of that organic matter?—No, I take the public health reports rather for that.

7490. I mean you had no direct experiments. You have cultivated microbes in it, but you have not shown that it does any harm itself?—You mean whether it is poisonous.

7491. Yes?—No, I have not, but it has been done.

7492. The results are very contradictory?—Very contradictory. I much prefer to take the public health reports and say that where this impurity exists in large quantities there unquestionably the mortality is greater—not only general mortality, but from special diseases, particularly phthisis.

7493. Have you any evidence as to the incidence of phthisis being specially great in these sheds?—Quite the contrary. In these well-ventilated sheds it was less than in the dry sheds.

7494. Even in the dry sheds is there much evidence of phthisis in the cotton-weaving trade?—There was far more than there ought to be, but that, of course, comes from various causes.

7495. We had figures from Dr. Greenwood, of Blackburn, which showed that the weavers were not more liable to phthisis than other people?—But they are unfortunately liable to it, and the rate is certainly higher than it ought to be; but that is very much a question of infection.

7496. Working in a weaving shed did not seem to give them a peculiar liability to it?—Then, again, it is a comparative thing, and the filth and other matters in these weaving sheds would be liable to cause a cultivation of the infecting germ.

7497. (Chairman.) We have been considering for various purposes whether it would be possible to raise the standard of ventilation—by "raise" I mean give the standard of CO_2 a higher proportion?—Increase the amount of respiratory impurities?

7498. Instead of fixing, as at present, nine parts in 10,000, say 12 parts. Of course, to do that would be a great saving of expense to manufacturers. It might to some extent reduce the desire to infuse artificial moisture, and in that way the health of the worker, or at any rate his comfort, would be considerably increased. Now we would like to know whether we could safely raise the standard of CO_2 ?—So far as my own opinion goes, Mr. Chairman, I should say it would be very dangerous. Wherever the standard of ventilation has been lowered there the health has deteriorated; wherever the standard has been improved mortality has diminished. That is what I mean by saying that I appeal to the public health records. I think I could say with absolute confidence that that is the case universally. Wherever good ventilation or better ventilation has been introduced, as into prisons and into ships, into places of all kinds such as public institutions and barracks, there the mortality has always diminished, and especially the mortality from phthisis.

7499. We have to try and reconcile the evidence that we have had. Of course, we have had a great deal of evidence that people work apparently without any injury to health whatever in atmospheres where the CO_2 goes up to 20 or even 30 parts?—In mines.

7500. In mines, and as a matter of fact there is no doubt that that amount is found in a very large number of our workshops to-day; but, at any rate, the evidence before us has referred chiefly to mines. Well, we have to consider whether we are justified in requiring manufacturers to run ventilating plant at a considerable cost if the standard can be raised?—You mean the quantity of carbonic acid raised?

7501. (Mr. Shackleton.) Yes, the number of volumes?—The standard lowered.

(Chairman.) You may put it that way.

7502. (Professor Lorrain Smith.) Perhaps we might also put this consideration before you, Dr. Ransome, that if you raise the standard of CO_2 a little you require less artificial humidity?—Yes.

7503. The artificial humidity that is introduced has been very seriously complained of?—Yes.

7504. That is perhaps one of the chief complaints that we have heard from those who have to work in those conditions. Then the question arises if you were to raise the volume of CO_2 in standard air you would have less call to introduce artificial humidity, because you would not have the volume of air passing through the place, it would not be so dry, and the breath which gives rise to the CO_2 also gives rise to a certain amount of humidity, so that it would seem to be a compromise between two conditions: if you lower the amount of CO_2 you necessarily make greater demands for artificial humidity, and that is what is gravely complained of?—I should look with very great misgiving upon any attempt to lower the standard or to raise the amount of carbonic acid, to raise the amount of respiratory impurity in the air. That is what I appeal to, not the amount of CO_2 , but the

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amount of respiratory impurity in the air; I should consider that would do far more harm to the health of the people than any increase of the amount of humidity in the air.

7505. (*Chairman.*) You think the respired air is accurately measured by the CO_2 test?—It is not accurately measured, but it is a fair approximation that has been tested by De Chaumont and others.

7506. (*Professor Lorrain Smith.*) It has been put before us in evidence that we ought to regard the wet bulb temperature as equivalent to the CO_2 test?—I greatly sympathise with the Chairman's idea about the amount of humidity; but I should hope that there are ways of fixing that at a somewhat lower rate without injuring the manufacturer. I cannot help thinking that with lowered temperatures in the sheds, if it could be done by means of spraying the air, you could get a lower amount of humidity, because there would be less total moisture than there would in the other case.

7507. You would get the higher percentage with a less total quantity?—I am inclined to sympathise with the Committee. Mr. Wilson has told me it was generally the idea of the Committee that a certain amount of discomfort, at any rate, is produced by a large amount of moisture in the air at a high temperature. I was particular in saying that I did not think that in our previous report we could say there was actually no injury caused by the amount of humidity in the air; we could say that it was simply owing to the better ventilation, and therefore the greater purity of the air, that there was less harm done in the humidified sheds than in the dry sheds.

7508. (*Chairman.*) Did they enquire into the question of dry sheds?—Yes, we went through both sets of sheds.

7509. Can you tell us why no standard of purity for the air was recommended for the dry sheds?—It was simply the law that the ventilation was not required in the dry sheds, but ventilation of other places was recommended in our Report.

7510. But is there any reason why a dry shed should be exempted from a standard of ventilation?—On the contrary, I think it is quite the other way. You say is there any reason. I believe there are practical reasons why they do not ventilate dry sheds; one is that it clears away the emanations from the bodies of the workpeople, therefore clears away a certain amount of humidity, and therefore makes it harder to work. I believe that is the real practical reason why they do not ventilate; and they are not required to ventilate.

7511. But, if we are to take the feelings of the workers as some indication of the discomfort and presumably the health enjoyed by them, we find that although in all these years there has been no standard of ventilation for the dry sheds, not a single complaint has come from the workers, although the CO_2 in many instances has gone up to 20, or even much higher proportions; yet there has not been a single complaint from the workers?—I am afraid, Mr. Chairman, I should attribute very little value to that fact. The people do not notice it; they do not care; they do not realise the harm that it does them in the way of dying of phthisis; they cannot tell; they live in their own rooms at home in an atmosphere that is perfectly vile, yet they never make any complaint. The fact of their not having made complaints, I think, is of no value whatever.

7512. Would you recommend a standard of ventilation for dry sheds?—I should, indeed.

7513. At what would you put it?—I should like to put exactly the same, nine parts in 10,000.

7514. (*Professor Lorrain Smith.*) Where do we get this evidence of phthisis being more abundant or prevalent in the dry sheds than in the wet sheds?—We had evidence before us in our Committee, and I have read in subsequent reports on the cotton cloth factories that the amount of phthisis has distinctly diminished since the improved ventilation was imperative, was made law. There are successive reports of Mr. Williams, and Dr. Whitelegge also sent me reports.

7515. That would apply to the wet sheds?—That would apply to the wet sheds, that is to say, that the ventilation has produced that beneficial influence; but the amount of phthisis in the dry sheds was certainly greater than that in the wet sheds.

7516. (*Chairman.*) You have doubtless read Dr. Haldane's report on ventilation which came out some years ago?—I think I did. I think it was in consequence of that that Sir Henry Roscoe and I went to the Home Office and protested.

7517. Protested against what?—Against his standard.

7518. Against the standard that he proposed?—Yes.

7519. We have had evidence from Dr. Pembrey, Dr. Hill, Dr. Boycott and Dr. Haldane?—As regards the relative amount of disease?

7520. As to the probable effects on health from lowering the standard, and unhappily?—They are opposed to me?

7521. Yes, they are, I am afraid?—I can only state my very strong conviction.

7522. That is what we naturally would expect.

(*Mr. Shackleton.*) I take it, Mr. Chairman, that the witnesses you have referred to laid greater stress upon the question of the wet bulb than they did on the CO_2 . That is the position.

7523. Now I want to put one or two questions in regard to the workpeople themselves. We have to deal with how they feel, and what they say to us about the conditions. They tell us quite frankly that the condition, so far as their bodily comfort is concerned, is worse in a wet shed under the Act than in an ordinary dry shed?—That I can quite understand.

7524. They prefer to have the so-called dry shed?—With no ventilation.

7525. Or very little. Many of them are ventilated a little bit, and return a fair standard?—I can quite understand that.

7526. And they prefer that. Now you also made a statement with regard to the impurities. Do not you think that the fact that the weavers are working in a damp atmosphere, that is damp relatively, anywhere over 65° wet bulb, that that in itself will have a tendency to throw off more impurity. Say you are working in a humid atmosphere, not simply sitting there, but working physically; the fact that you are working in an atmosphere that is anywhere about 70° to 75° wet bulb, must of necessity cause you to sweat more and throw off more impurities?—Yes.

7527. I want to know whether you would not favour a method by which the wet bulb could be kept down from that point of view?—I would, indeed; but if it is to be done by doing away with the ventilation I should be afraid of the results. I do not say how much, but certainly very much greater bad effects than those by a greater amount of humidity would be produced.

7528. If it were possible to keep down the impurities, you think that is far preferable to any scale increasing the difference between the dry and the wet bulb. Take 80° dry, what will it show the wet bulb on the schedule?— 74° .

7529. It would be far better, whatever the difference was there, to keep that down to 65° if possible, even though the relative difference was much less?—I should not think there is any great harm in anything below 70° .

7530. My point is this: at 69° dry we should have 65° wet; at 80° we should get 74° ; there is the difference of 4° and of 6° .

(*Mr. Roberts.*) That may not be quite right.

7531. (*Mr. Shackleton.*) The point is this: although we allow a bigger difference between one and the other, I want your view as to whether 65° would not be far better from the point of view of health, and throwing off bad gases as a result of extra exertion at the higher rate, although the relative humidity was less—which would you prefer?—I think the relative humidity is of great importance. The greater the difference between the wet and the dry bulb thermometers with the greater ease will the emanations pass off, and will be carried off by the ventilation.

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7532. However, working at 74° wet bulb and 80° dry bulb is much more uncomfortable than at 65° wet and 69° dry. The weaver is much warmer, and she throws off more sweat from the body, and in every way it is a worse position from the point of view of actual working?—But as regards carrying off the exhalations from the lungs and body it is much better to have the greater difference between the wet and dry bulbs.

7533. Which is the better, 65° and 69° or 74° and 80°—which is the better from the weaver's point of view?—I think I have answered that by saying that I do not think anything below 70° would do any real damage unless it were saturated, then I think it would. If there is a great difference between the wet and the dry bulbs at 70°, there, I think, you might very well improve upon that schedule by insisting on an increase of the difference. I do not think the difference goes up quick enough.

(Mr. Roberts.) The difference is 2° up to 70°.

7534. (Mr. Shackleton.) Where would you suggest the change should be made? At present we have 2°, as Mr. Roberts says, at 70°, and then it begins at 2·5°, 3°, and so on?—I should be inclined to begin even a little below 70°, say at 65°.

7535. Would you make it 3° or 4°?—I should make it 3° after that, and still more and more as you go on increasing the temperature.

7536. You think that the two degrees should cease below 65° wet?—Yes, I think so, so as to get a greater difference above 70°.

7537. (Chairman.) Might I suggest that that is a point that perhaps Dr. Ransome would like to think out and send us some ideas on the point.

(Witness.) In an inexact way Sir Henry Roscoe and I talked that matter over last evening. We both agreed that the schedule might be amended very well in the direction that I have indicated.

7538. We have a certain number of direct proposals for dealing with the schedule, or for doing away with the schedule, but we should like to have your direct proposal after you have had time to think it out. It is hardly fair to ask you to give an answer upon a point of such importance right off?—I am afraid, as a non-practical man, not having experience of these different sheds, it would be very difficult for me to actually draw up a schedule—it comes to that—it would be drawing up a special schedule.

7539. You say that, beginning somewhere about 65°, you would widen the differences between the bulbs?—That is only my own suggestion, without any particular value, because I have no practical knowledge of the working of the thing. I should think a man like Mr. Williams would be far better able to answer a question of that kind.

7540. (Mr. Shackleton.) All the trouble arises after that point?—I quite understand that. I also say that, merely from medical knowledge I am quite willing to believe what you say you have ascertained—that a certain amount of discomfort, and possibly a lowering of the power of resistance of the body, is caused by high degrees of humidity.

7541. In answer to one of my questions you said you were not surprised at the weavers preferring a dry shed with increased CO₂ as against a wet shed under the Act. Can you give me the reason why you are not surprised?—They are terribly afraid of draughts, for one thing. Another is that they like a close atmosphere; they prefer it. Witness the rooms they will congregate in—public houses, theatres, and places of public assembly—and yet not complain in the least of the vile atmosphere that prevails in those places. I am not surprised that they do not make any complaint, but I know I should.

7542. (Mr. Thomas.) Is that because you think they feel more comfortable?—I daresay they feel more comfortable, but they do not realise the harm that it is doing to their health.

7543. You look at it from the health point of view, and they look at it from the point of view of comfort?—Yes.

7544. (Mr. Shackleton.) One other question. I am going to give you readings taken in two sheds within ten minutes of one another, and it is puzzling us to know why there should be this difference. We went

into a dry shed a few yards away from the other one and found the thermometers at 72° dry and 65° wet. Across the road, or nearly so, we found in a shed on the same afternoon the thermometers at 84° dry and 72° wet, a difference of 12° in the dry heat. The only difference so far as we gathered was that one was a wet shed and the other a dry shed. Is there any reason at all why the heat should be so different?—There was no difference in the sunshine?

7545. No, it was in the same district, on the same day.

(Mr. Higson.) They might not have the same aspect.

(Mr. Roberts.) I think that is hardly a question that Dr. Ransome could be expected to answer, but it might be answered if he were to go to the sheds.

7546. (Witness.) I do not think I could answer it.

(Mr. Shackleton.) There must be in some of these sheds unnecessary heating.

(Mr. Roberts.) I should like to answer that question of Mr. Shackleton privately.

(Mr. Shackleton.) There seems to be unnecessary heating.

(Chairman.) I suppose there was a heating pipe in one and not in the other.

(Mr. Roberts.) It is not that I do not wish every member of the Committee to hear my answer, but I do not want it given as evidence.

7547. (Mr. Shackleton.) It bears upon this fact: when you have two sheds running side by side like these it is not possible to persuade a weaver, no matter what the condition of the CO₂, that he is better off 12° hotter. There was a humidity of 78°, 6° down. The condition of the sheds was altogether different. I want the doctor to see the difficulty we have in persuading any weaver where the same conditions apply, much cooler so far as smell and feeling, and much more healthy; then on the same day one was with steam and the other without. It is an absolute impossibility to persuade the workpeople?—That I can quite understand. They have got it into their heads that they are boiled alive with the steaming, and that the steaming does them harm; and it is so firmly fixed in their minds that I am afraid that no amount of persuasion would make them see differently.

7548. (Chairman.) Now, going back to the ballot, of course, we have to bear this in mind: the weavers are piece-workers, and it is generally admitted that steaming or moisture does facilitate weaving; and consequently, in giving opinions against steaming workers are giving evidence and holding opinions contrary to their own interests?—Entirely.

7549. The abolition of steaming means to them possibly reduction of wages?—Yes.

7550. Consequently, rightly or wrongly, one cannot for a moment doubt that these feelings are very strongly ingrained, and they are the result of experience of ten years or more?—And that very argument appealed to us. We felt sure there must be something in the complaints that were made, and there was at that time, and probably there is now; and that is why I think it is quite likely that you are on the right track when you are trying to lower the height of the wet bulb thermometer.

7551. Just to come back for a moment to this difficult question of the CO₂. Of course, we know that such authorities as Parkes and De Chaumont, and other writers have said that the desirable condition of things is about six parts of CO₂ in 10,000, and other writers on hygiene have always said that a large amount of CO₂ is undesirable; but have there been any actual experiments. There has been the general idea that you should have the conditions as near a natural state of things as possible, but is there any evidence whatever based upon actual experiment, or coming from any reliable source, to say that (say) 15 parts of CO₂ or 20 parts of CO₂ with air such as you would find in a weaving shed will do or ever have done any damage to anybody at all? Is it mere speculative opinion, a mere theory, or is it based upon experiment, or any actual reliable evidence?—It is based really upon experiments upon an enormous scale; the results of better ventilation in these different public institutions that I have spoken of. The amount necessary to keep down the respiratory impurities to 2 parts per 10,000 is 3,000 cubic feet per head per

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hour; and where that has been introduced the mortality has diminished enormously.

7552. Is it possible to refer to that? We find it in text books, and we find it in generally expressed opinions, but are there any references to any actual experiments or any reliable data to show that this is the case?—Certainly. I think you may take the records of the mortality in the British Army before and after the improvement in the ventilation of the barracks. The mortality in the British Army before the Crimean War from phthisis, fevers and other diseases was something enormous. When the stipulation was made that 3,000 cubic feet per head per hour was to be the standard of ventilation that mortality diminished to the mortality of the ordinary civil population of the country, and below it; and in our gaols especially the mortality has diminished to a perfectly enormous extent. The gaols are now the most healthy places to live in.

7553. There may be various causes. As far as the Army is concerned in the days we speak of there was drunkenness and dissipation which practically does not exist now. That might be the cause?—Yes, but it sprang up so quickly—I mean the improvement took place so quickly that it could hardly be from a general improvement such as you point out.

7554. (*Professor Lorrain Smith.*) Are they better fed in the gaols, too?—Yes, they are better fed than they were, certainly. The hygiene of gaols is almost perfect.

7555. So that it is not necessarily ventilation alone?—Oh dear, no, certainly not.

7556. (*Mr. Thomas.*) May I put this question on the same point. I think you were very emphatic in the statement that it would be dangerous to move from 9 volumes of CO₂ up to 12 volumes, and in continuation of that statement you said that in all cases where the standard of ventilation had been raised, or lowered as we call it, that it had had beneficial results. Were you thinking at that moment that the change from 9 to 12 would be dangerous, or when you referred to beneficial results were you thinking of lowering it from 20 down to 14, say? I do not know whether you can see the drift of my question or not. What I mean really is this: in lowering from 12 to 9 would you get the same value or the same beneficial results as you would from lowering from 20 to 14?—I really could not answer that. That is a quantitative question that I am afraid I could not answer. I should answer merely in general terms, that any lowering of the standard will be what I call dangerous to health; that is to say, that there would be danger. I do not say it actually would injure health immediately, but I say that there would be danger that the mortality would be increased by lowering the standard to 12 volumes instead of 9.

7557. But you see we can start off with 4, but if we make it 5 it is getting dangerous?—No, I do not think so.

7558. It is a question of degree, perhaps?—I dare say it is better with this system of open air treatment that is going on nowadays. There is no doubt that people are getting still fonder and fonder of perfectly pure air, but the partially impure air of 6 parts per 10,000 does no harm—I think that is pretty certain, because that is a standard that has been set up in our prisons; and our prisons, as I say, are about the most healthy places to live in. There you have an experiment on an enormous scale.

7559. You do not get the humidity, perhaps, in a prison the same as you get in humidified factories?—No, certainly the question of humidity does not come in. I am speaking now off the book, but I do not myself believe that a certain amount of humidity would do any particular harm to health if it does not go beyond a certain point; and you have the opinions of eminent men like Dr. Parkes that a degree of humidity of about 70 or up to 75 is quite wholesome and does no harm, and, on the contrary, is very pleasant to the body.

7560. Do you think that dry sheds are in some way responsible for the high death rate from phthisis?—I do.

7561. In humid sheds do you think it is much reduced?—Yes, partly because of the better ventilation, and also I think very much because of the precipitation of microbes from the air. There is less

dust. We have proof that there is considerably less dust in the humid sheds than in the dry sheds.

7562. You do not think that there is any other kind of disease that may be created by this humidity?—I do not, indeed. You mean such as rheumatism?

7563. Yes?—There again comes in a matter of going out with damp clothes into the open air. I think that would be likely to arise. I think rheumatism would be likely to arise, and it was on that account that the provision of dry cloak rooms was made.

7564. They cannot strip entirely, and they are bound to come out with some amount of moisture on them?—If there are dry clothes put over wet ones it diminishes the danger very much; there is no evaporation from the surface, and therefore there is no chill.

7565. According to the operatives' statement they quite prefer the phthisis to the rheumatism.

(*Mr. Roberts.*) I do not think it is quite fair to put it in that way. I do not think the operatives put it that way.

7566. (*Chairman.*) Is there any other point that strikes you?—May I ask whether you would like me to consult with Sir Henry Roscoe and Mr. Williams on this point of altering the schedule? I think it would be better for you to ask them yourself.

7567. We have had Mr. Williams' evidence?—But on this point I mean.

7568. I am not quite sure?—These men are practical men, and for me to consult them would be merely putting questions such as you yourselves would be able to put.

(*Mr. Shackleton.*) I think, Mr. Chairman, if Dr. Ransome would kindly consult Sir Henry Roscoe and then give the result as his own evidence afterwards I should be pleased to see it. I think it is important because they are the two men now out of the three that really do know what was in the minds of the framers of that schedule.

7569. (*Witness.*) Sir Henry Roscoe was the originator of it. I can only tell you what he told me last night, that he thought that you might very well make a difference at the higher degrees of temperature, that is, a greater difference between the wet bulb and the dry bulb thermometers. As to the actual amounts I do not know that he could do it in any way other than by a certain amount of guesswork. You have his opinion now given you through me that it might be altered with advantage.

7570. (*Professor Lorrain Smith.*) In addition to that wider separation of the wet and dry bulbs, have you considered the limit of temperature at which work should be permitted?—No, I have said already that I thought that working with a high wet bulb thermometer, say above 75°, was likely to produce discomfort at least; I cannot say whether it would produce actual disease. I should be very timid in the absence of ventilation.

7571. You are getting on to the temperatures where you might have heat stroke; you get to about 80°?—There is no doubt that in a hot humid climate people cannot work so well as they can in a temperate climate.

7572. The schedule goes up?—I think it is unnecessary to take those high temperatures.

7573. 91° wet bulb is the highest. It goes up to that, and that is a very considerable amount above 75°?—Yes.

7574. You did not go into that question?—I think you will find that schedule was made in a very mechanical sort of way.

7575. We need not regard that as any guide upon that point?—No, and I think if Sir Henry Roscoe were set to do it again he would again have to make a sort of rule of 'thumb business of it; and I think you will be the better qualified to-day from having heard all this evidence.

7576. (*Mr. Shackleton.*) The highest we have seen this year is 84° wet bulb.

(*Professor Lorrain Smith.*) Apparently at that point of working you are at a dangerous temperature?—I should be very glad to see that altered.

7577. Of course, there are experiments with heat stroke that have been recently carried out, showing that you are very near a dangerous point then?—Yes, just so.

The witness withdrew.

COMMITTEE ON HUMIDITY IN COTTON-WEAVING SHEDS.

APPENDICES.

APPENDIX I.

EXPLANATORY LETTER, TABLES AND DIAGRAM FROM MR. FRANK SCUDDER, F.I.C.

44, Mosley Street,
Manchester.
January 9th, 1908.

Dear Sir,

Herewith I enclose you two tables and a diagram referred to in my evidence, together with an extract also referred to from Wm. Thomson's book on "The Sizing of Cotton Goods."

Shortly stated the tables and diagrams have been prepared to show:—

1. That the present Schedule is sufficient to control a weaving shed from excessive humidity;
2. That if the temperature of the wet bulb thermometer be lowered three degrees below the present standard, an atmosphere is produced detrimental to the satisfactory weaving of sized goods;
3. That the "chilling" effect produced on a person leaving the shed at the temperature set forth on the diagram, and coming into air at 50° F., will not

be materially remedied by lowering the present standard three degrees.

I have further shown by horizontal lines on Tables 1 and 2, and by vertical lines on diagram the range of temperatures at which artificial humidification becomes necessary—viz., temperatures from 60° F. to 85° F. in sheds which are warmed and ventilated.

As I have told the Committee, I know of no valid reason why a temperature over 85° F. should be maintained in a shed, except in cases of climatic conditions beyond the control of the manufacturer; that is to say, excessive summer heat.

I am,
Yours sincerely,
FRANK SCUDDER.

D. R. Wilson, Esq.,
Secretary, Humidity Committee,
Home Office, S.W.

THE SIZING OF COTTON GOODS, by WM. THOMSON. (page 115.)

"If the air at 32° F. be admitted to a shed which is heated to 65° F., its temperature, and therefore its saturating point, is at once raised, and it commences to absorb moisture from everything which contains it. It absorbs the moisture from the warp and weft, and thus greatly reduces its strength; and from a few experiments made lately by the author it appears that cotton thread when deprived especially of its natural moisture (*i.e.*, an amount of about 8 per cent., which is always found in cotton), its strength is very rapidly decreased in proportion. This point was tested by taking nine different leas of the same yarn. A lea is a small hank, produced by wrapping on a reel having $\frac{3}{4}$ circumference of 54 inches, eighty threads of yarn; a lea, therefore, is 120 yards in length. These were accurately weighed separately, and each placed in a stoppered glass tube; three of them were afterwards put in a steam bath to dry at 212° F., and then transferred when dry to stoppered test-tubes.

"Three were placed over some water contained in a plate, which was gently heated under a large glass

bell-jar, to allow them to absorb as much moisture as possible, and then placed in stoppered tubes as before, whilst the remaining three were left in the original test-tubes, thus representing the yarn in its original condition. All these leas were broken by means of the "strain testing" apparatus, each then weighed, dried, and weighed again, and the following results of each three leas obtained, which speak for themselves:—

Original weight of yarn. Grains.	Condition of same.	Percentage of moisture.	Breaking strain. lbs.
(1) 33.21	Unaltered	8.93	64
(2) 33.33	Moistened	17.39	69.2
(3) 33.85	Dried	2.89	39.9

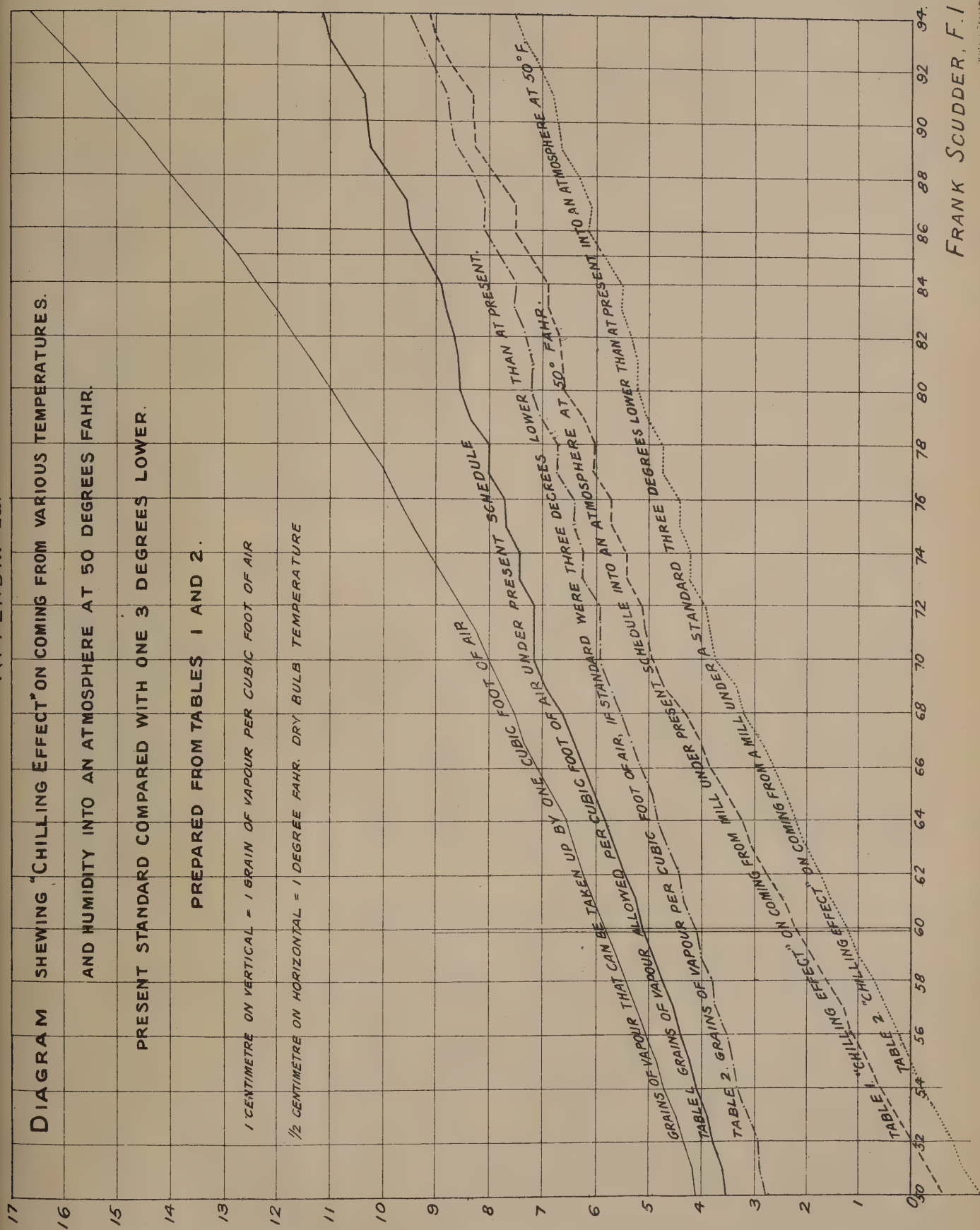
"An increase of moisture to the extent of 8.46 per cent. over the natural amount contained in the yarn only increases the strength by 5.2 lbs. on each lea, whilst a decrease of 6.04 per cent. from the natural moisture reduces the strength by 24.1 lbs. on each lea."

TABLE A.—MAXIMUM LIMITS OF HUMIDITY OF ATMOSPHERE AT GIVEN TEMPERATURES PERMITTED BY THE FACTORY ACT.

Thermometer readings.		Wet bulb reading for saturation or dew point.	Fall of temperature below above standard necessary to reach saturation.	Fall of temperature below dry bulb to reach saturation.	Grains of vapour.		Vapour required to saturate difference.	Percentage humidity saturation = 100.	If the temperature fell to 50° F. then the air would hold.	Causing a dampness or "chilling effect" in the following ratio.	Ultimate effect of cooling the air to 50° F.	
Dry bulb.	Wet bulb.				That can be taken up by 1 cub. ft. of air at D.B. temperature.	Allowable in 1 cub. ft. of air.					Water produced.	Water in air.
°F.	°F.	°F.	°F.	°F.	grs. per c. ft.	grs. per c. ft.	grs. per c. ft.		grs. per c. ft.		grs. per c. ft.	grs. per c. ft.
35	33	29.8	3.2	5.2	2.39	1.9	0.49	80	—	—	—	—
36	34	31.0	3.0	5.0	2.48	2.0	0.48	82	—	—	—	—
37	35	32.2	2.8	4.8	2.57	2.1	0.47	83	—	—	—	—
38	36	33.3	2.7	4.7	2.66	2.2	0.46	83	—	—	—	—
39	37	34.4	2.6	4.6	2.76	2.3	0.46	84	—	—	—	—
40	38	35.4	2.6	4.6	2.86	2.4	0.46	84	—	—	—	—
41	39	36.5	2.5	4.5	2.97	2.5	0.47	84	—	—	—	—
42	40	37.5	2.5	4.5	3.08	2.6	0.48	85	—	—	—	—
43	41	38.6	2.4	4.4	3.20	2.7	0.50	84	—	—	—	—
44	42	39.6	2.4	4.4	3.32	2.8	0.52	84	—	—	—	—
45	43	40.7	2.3	4.3	3.44	2.9	0.54	85	—	—	—	—
46	44	41.7	2.3	4.3	3.56	3.1	0.46	86	—	—	—	—
47	45	42.8	2.2	4.2	3.69	3.2	0.49	86	—	—	—	—
48	46	43.8	2.2	4.2	3.82	3.3	0.52	86	—	—	—	—
49	47	44.8	2.2	4.2	3.96	3.4	0.56	86	—	—	—	—
50	48	45.9	2.1	4.1	4.10	3.5	0.60	86	4.1	—0.6	—	—
51	49	46.9	2.1	4.1	4.24	3.6	0.64	86	3.9	—0.3	—	—
52	50	48.0	2.0	4.0	4.39	3.8	0.59	86	3.8	0.0	—	—
53	51	49.0	2.0	4.0	4.55	3.9	0.65	86	3.6	0.3	—	—
54	52	50.0	2.0	4.0	4.71	4.1	0.61	86	3.5	0.6	0.0	4.1
55	53	51.1	1.9	3.9	4.87	4.2	0.67	87	3.4	0.8	0.1	4.1
56	54	52.1	1.9	3.9	5.04	4.4	0.64	87	3.3	1.1	0.3	4.1
57	55	53.2	1.8	3.8	5.21	4.5	0.71	87	3.2	1.3	0.4	4.1
58	56	54.2	1.8	3.8	5.39	4.7	0.69	87	3.1	1.6	0.6	4.1
59	57	55.2	1.8	3.8	5.58	4.9	0.68	88	3.0	1.9	0.7	4.1
60	58	56.2	1.8	3.8	5.77	5.1	0.67	88	2.9	2.2	1.0	4.1
61	59	57.3	1.7	3.7	5.97	5.2	0.77	88	2.8	2.4	1.1	4.1
62	60	58.3	1.7	3.7	6.17	5.4	0.77	88	2.7	2.7	1.3	4.1
63	61	59.3	1.7	3.7	6.38	5.6	0.78	88	2.6	3.0	1.5	4.1
64	62	60.3	1.7	3.7	6.59	5.8	0.79	88	2.6	3.2	1.7	4.1
65	63	61.4	1.6	3.6	6.81	6.0	0.81	88	2.5	3.5	1.9	4.1
66	64	62.4	1.6	3.6	7.04	6.2	0.84	88	2.4	3.8	2.1	4.1
67	65	63.4	1.6	3.6	7.27	6.4	0.87	88	2.4	4.0	2.3	4.1
68	66	64.4	1.6	3.6	7.51	6.6	0.91	88	2.3	4.3	2.5	4.1
69	67	65.4	1.6	3.6	7.76	6.9	0.86	88	2.2	4.7	2.8	4.1
70	68	66.5	1.5	3.5	8.01	7.1	0.91	88	2.2	4.9	3.0	4.1
71	68.5	66.6	1.9	4.4	8.27	7.1	1.17	85.5	2.1	5.0	3.0	4.1
72	69	66.7	2.3	5.3	8.54	7.1	1.44	84	2.0	5.1	3.0	4.1
73	70	67.8	2.2	5.2	8.82	7.4	1.42	84	2.0	5.4	3.3	4.1
74	70.5	67.9	2.6	6.1	9.10	7.4	1.70	82	2.0	5.4	3.3	4.1
75	71.5	68.9	2.6	6.1	9.39	7.65	1.74	81.5	2.0	5.65	3.55	4.1
76	72	69.2	2.8	6.8	9.69	7.7	1.99	79	2.0	5.7	3.6	4.1
77	73	70.2	2.8	6.8	9.99	8.0	1.99	79	2.0	6.0	3.9	4.1
78	73.5	70.3	3.2	7.7	10.31	8.0	2.31	77	2.0	6.0	3.9	4.1
79	74.5	71.4	3.1	7.6	10.64	8.25	2.39	77.5	2.0	6.25	4.15	4.1
80	75.5	72.4	3.1	7.6	10.98	8.55	2.43	77.5	2.0	6.55	4.45	4.1
81	76	72.6	3.4	8.4	11.32	8.60	2.72	76	2.0	6.6	4.2	4.1
82	76.5	72.8	3.7	9.2	11.67	8.65	3.02	74	2.0	6.65	4.45	4.1
83	77.5	73.8	3.7	9.2	12.03	8.85	3.18	74	2.0	6.85	4.75	4.1
84	79	74.0	4.0	10.0	12.40	8.90	3.50	72	2.0	6.9	4.8	4.1
85	79	75.1	3.9	9.9	12.78	9.20	3.58	72	2.0	7.2	5.1	4.1
86	80	76.1	3.9	9.9	13.17	9.50	3.67	72	2.0	7.5	5.4	4.1
87	80.5	76.3	4.2	10.7	13.57	9.55	4.02	71	2.0	7.55	5.45	4.1
88	81.5	77.3	4.3	10.7	13.98	9.9	4.08	71	2.0	7.9	5.8	4.1
89	82.5	78.4	4.1	10.6	14.41	10.25	4.16	71	2.0	8.25	6.15	4.1
90	83.0	78.6	4.4	11.4	14.85	10.3	4.55	69	2.0	8.3	6.2	4.1
91	83.5	78.8	4.7	12.2	15.29	10.35	4.94	68	2.0	8.35	6.25	4.1
92	84.5	79.9	4.6	12.1	15.74	10.7	5.04	68	2.0	8.7	6.6	4.1
93	85.5	80.9	4.6	12.1	16.21	11.0	5.21	68	2.0	9.0	6.9	4.1
94	86	81.2	4.8	12.8	16.69	11.1	5.59	66	2.0	9.1	7.0	4.1
95	87	82.2	4.8	12.8	17.18	11.5	5.68	66	2.0	9.5	7.4	4.1
96	88	83.3	4.7	12.8	17.68	11.8	5.88	66	2.0	9.8	7.7	4.1
97	88.5	83.5	5.0	13.5	18.20	11.9	6.30	65.5	2.0	9.9	7.8	4.1
98	89	83.8	5.2	14.2	18.73	12.0	6.73	64	2.0	10.0	7.9	4.1
99	90	84.8	5.2	14.2	19.28	12.3	6.98	64	2.0	10.3	8.2	4.1
100	91	85.9	5.1	14.1	19.84	12.7	7.14	64	2.0	10.7	8.6	4.1

TABLE B.—MAXIMUM LIMITS OF HUMIDITY AT GIVEN TEMPERATURES WHEN PRESENT WET BULB STANDARD IS LOWERED THREE DEGREES.

Readings of Thermometers.		Wet bulb reading for saturation or dew point.	Fall of temperature below standard to reach saturation.	Fall of temperature below dry bulb to reach saturation.	Grains of vapour		Vapour required to saturate, difference.	Percentage of humidity (saturation =100).	If temperature fell to 50° F. then the air would hold.	Causing a dampness or "chilling effect" in the following ratio.	Ultimate effect of cooling air to 50° F.	
Dry bulb.	Wet bulb.				That can be taken up by 1 cub. ft. of air at D.B. temperature.	Allowable in 1 cub. ft. of air.					Water produced.	Water in air.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
°F.	°F.	°F.	°F.	°F.	grs. per c. ft.	grs. per c. ft.	grs. per c. ft.		grs. per c. ft.		grs. per c. ft.	grs. per c. ft.
35	—	—	—	—	2.39	—	—	—	—	—	—	—
36	31	23.5	7.5	12.5	2.48	1.5	0.98	59	—	—	—	—
37	32	24.9	7.1	12.1	2.57	1.6	0.97	61	—	—	—	—
38	33	26.2	6.8	11.8	2.66	1.7	0.96	62	—	—	—	—
39	34	27.4	6.6	11.6	2.76	1.7	1.06	63	—	—	—	—
40	35	28.5	6.5	11.5	2.86	1.8	1.06	63	—	—	—	—
41	36	29.7	6.3	11.3	2.97	1.9	1.07	64	—	—	—	—
42	37	30.9	6.1	11.1	3.08	2.0	1.08	66	—	—	—	—
43	38	32.0	6.0	11.0	3.20	2.1	1.10	65	—	—	—	—
44	39	33.1	5.9	10.9	3.32	2.2	1.12	65	—	—	—	—
45	40	34.2	5.8	10.8	3.44	2.3	1.14	66	—	—	—	—
46	41	35.3	5.7	10.7	3.56	2.4	1.16	67	—	—	—	—
47	42	36.4	5.6	10.6	3.69	2.5	1.19	67	—	—	—	—
48	43	37.5	5.5	10.5	3.82	2.6	1.22	67	—	—	—	—
49	44	38.6	5.4	10.4	3.96	2.7	1.26	67	—	—	—	—
50	45	39.7	5.3	10.3	4.10	2.8	1.30	68	4.1	—1.3	—	—
51	46	40.8	5.2	10.2	4.24	2.9	1.34	68	3.9	—1.1	—	—
52	47	41.9	5.1	10.1	4.39	3.0	1.39	69	3.8	—0.8	—	—
53	48	43.0	5.0	10.0	4.55	3.1	1.45	69	3.6	—0.5	—	—
54	49	44.1	4.9	9.9	4.71	3.3	1.41	69	3.5	—0.2	—	—
55	50	45.2	4.8	9.8	4.87	3.4	1.47	70	3.4	0.0	—	—
56	51	46.3	4.7	9.7	5.04	3.5	1.54	70	3.3	0.2	—	—
57	52	47.4	4.6	9.6	5.21	3.7	1.51	70	3.2	0.5	—	—
58	53	48.5	4.5	9.5	5.39	3.8	1.59	71	3.1	0.7	—	—
59	54	49.5	4.5	9.5	5.58	4.0	1.58	71	3.0	1.0	—	—
60	55	50.6	4.4	9.4	5.77	4.1	1.67	71	2.9	1.2	0.0	4.1
61	56	51.7	4.3	9.3	5.97	4.3	1.67	72	2.8	1.5	0.2	4.1
62	57	52.7	4.3	9.3	6.17	4.4	1.77	72	2.7	1.7	0.3	4.1
63	58	53.8	4.2	9.2	6.38	4.6	1.78	72	2.6	2.0	0.5	4.1
64	59	54.8	4.2	9.2	6.5	4.8	1.79	72	2.6	2.2	0.7	4.1
65	60	55.9	4.1	9.1	6.81	4.9	1.91	73	2.5	2.4	0.8	4.1
66	61	57.0	4.0	9.0	7.04	5.1	1.94	73	2.4	2.7	1.0	4.1
67	62	58.0	4.0	9.0	7.27	5.3	1.97	73	2.4	2.9	1.2	4.1
68	63	59.1	3.9	8.9	7.51	5.5	2.01	73	2.3	3.2	1.4	4.1
69	64	60.1	3.9	8.9	7.76	5.6	2.06	73	2.2	3.5	1.6	4.1
70	65	61.1	3.9	8.9	8.01	5.9	2.11	73	2.2	3.7	1.8	4.1
71	65.5	61.3	4.2	8.7	8.27	5.9	2.27	71	2.1	3.8	1.8	4.1
72	66	61.5	4.5	10.5	8.54	5.9	2.64	69	2.0	3.9	1.8	4.1
73	67	62.6	4.4	10.4	8.82	6.2	2.62	70	2.0	4.2	2.1	4.1
74	67.5	62.7	4.8	11.3	9.10	6.2	2.90	68	2.0	4.2	2.1	4.1
75	68.5	63.8	4.7	11.2	9.39	6.4	2.99	68	2.0	4.4	2.3	4.1
76	69	64.0	5.0	12.0	9.69	6.4	3.29	67	2.0	4.4	2.3	4.1
77	70	65.1	4.9	11.9	9.99	6.7	3.29	67	2.0	4.7	2.6	4.1
78	70.5	65.2	5.3	12.8	10.31	6.7	3.61	65	2.0	4.7	2.6	4.1
79	71.5	66.3	5.2	12.7	10.64	7.0	3.64	65	2.0	5.0	2.9	4.1
80	72.5	67.3	5.2	12.7	10.98	7.2	3.78	65	2.0	5.2	3.1	4.1
81	73	67.6	5.4	13.4	11.32	7.2	4.12	64	2.0	5.2	3.1	4.1
82	73.5	67.8	5.7	14.2	11.67	7.3	4.37	62	2.0	5.3	3.2	4.1
83	74.5	68.8	5.7	14.2	12.03	7.5	4.53	62	2.0	5.5	3.4	4.1
84	75	69.1	5.9	14.9	12.40	7.5	4.90	60	2.0	5.5	3.4	4.1
85	76	70.1	5.9	14.9	12.78	7.8	4.98	61	2.0	5.8	3.7	4.1
86	77	71.2	5.8	14.8	13.17	8.1	5.07	61	2.0	6.1	4.0	4.1
87	77.5	71.2	6.3	15.8	13.57	8.1	5.47	60	2.0	6.1	4.0	4.1
88	78.5	72.4	6.1	15.6	13.98	8.3	5.68	58	2.0	6.3	4.2	4.1
89	79.5	73.5	6.0	15.5	14.41	8.6	5.81	60	2.0	6.6	4.5	4.1
90	80.0	73.7	6.3	16.3	14.85	8.7	6.15	59	2.0	6.7	4.6	4.1
91	80.5	74.0	6.5	17.0	15.29	8.8	6.49	58	2.0	6.8	4.7	4.1
92	81.5	75.0	6.5	17.0	15.74	9.0	6.74	58	2.0	7.0	4.9	4.1
93	82.5	76.1	6.4	16.9	16.21	9.3	6.91	58	2.0	7.3	5.2	4.1
94	83	76.4	6.6	17.6	16.69	9.5	7.19	57	2.0	7.5	5.4	4.1
95	84	77.4	6.6	17.6	17.18	9.8	7.18	57	2.0	7.8	5.7	4.1
96	85	78.5	6.5	17.5	17.68	10.1	7.58	57	2.0	8.1	6.0	4.1
97	85.5	78.8	6.7	18.2	18.20	10.1	8.10	56	2.0	8.1	6.0	4.1
98	86	79.0	7.0	19.0	18.73	10.2	8.53	55	2.0	8.2	6.1	4.1
99	87	80.1	6.9	18.9	19.28	10.5	8.78	55	2.0	8.5	6.4	4.1
100	87	81.2	6.8	18.8	19.84	10.9	8.94	55	2.0	8.9	6.8	4.1



FRANK SCUDDER, F.I.C.

APPENDIX II.

STATEMENT BY MR. C. E. PRINGLE, H.M. INSPECTOR OF FACTORIES.

General.

I have had it stated to me that the regularity in weaving conditions induced by humidity manifests itself in a diminution of the number of shuttles flying. The most prolific cause of such accidents is the breaking of ends.

I find that in 1906, 564 humid sheds returned 65 shuttle accidents, and 815 non-humid sheds 62 shuttle accidents. The use of a shed as a unit of comparison is, of course, unsatisfactory.

It might be of interest to refer to the 65 accidents reported from humid sheds, and after selecting those due to the cause mentioned above, to further investigate these in comparison with the records of humidity, to ascertain whether at the time when the accidents occurred the humidity was less than normal.

I think that the twelve months' limit prescribed in Section 95 of the Factory and Workshop Act, 1901, might very well be abolished, and the practice in cotton cloth cases made conformable to the usual system with regard to prosecutions.

Reference (1).

With a view to ascertaining the actual conditions which obtain in weaving sheds, I have analysed the figures taken at the time of sampling in the case of all samples secured in the Blackburn C. C. F. District in the year beginning 1st May, 1906, and ending 30th April, 1907. (Samples taken by Messrs. McNair and Wilson are not included.) I have selected these months because they include a summer more normal than that of the present year. I have used Blackburn results in preference to Manchester ones because the Blackburn sampling is more evenly divided between morning and afternoon, and hence the figures offer a more reliable average. If desired I can supply similar figures for the Manchester district for 1st May to 30th September, 1907.

The principal classes of goods are:—

			Sheds.
Heavy sized ("shirt-ings"), sized for "weight."	Up to 180 per cent.	Practically all humid.	
Light sized, sized for "weaving."	Up to 20 per cent.	Humid and dry.	
Coloured goods	About 5 per cent.	Practically all dry.	

There is also a class of goods, manufactured on broad looms, velvets, sheetings, etc., produced principally near Oldham. This class is, I believe, comparable with the coloured class both as regards conditions of manufacturing and sheds, but I do not think that this branch of the subject has been thoroughly investigated.

Certain tables are annexed:—

A.—HUMID SHEDS.

Monthly and yearly averages of:—

- Inside temperatures.
- Outside temperatures.
- Excesses of inside over outside temperatures.
- Humidities.

B.—DRY SHEDS.

Monthly and yearly averages of:—

- Inside temperatures.
- Outside temperatures.
- Excesses of inside over outside temperatures.

C.—Particulars as in B, plus details of inside and outside humidities of certain sheds tested in September, October, November, and December, 1907.

Broadly speaking, a temperature of 70° F. appears to be the ideal one for weaving, possibly up to 5° higher on occasion for heavily-sized goods, and 5° lower for other classes. As regards humidity, an average of 76 per cent. is required for goods woven in wet sheds, and 66 per cent. for those dealt with in dry sheds. Probably the averages for both classes are affected by the number of places included, which size for weaving only, if 68 per cent. to 72 per cent. is taken as necessary for these, the humidity for heavily-sized goods may reach 78 per cent. to 80 per cent., and for coloured goods be reduced to about 64 per cent.

A.—HUMID SHEDS: MONTHLY AVERAGES.

Month.	Number of Sheds Tested.	Inside Temperatures.	Outside Temperatures.	Excess of Inside over Outside Temperature.	Percentage of Humidity in Sheds.
January (1907) - - - -	38	66·4	43·3	23·1	78·0
February - - - -	8	64·5	36·8	27·7	72·8
March - - - -	25	67·2	45·8	21·4	77·5
April - - - -	62	68·5	51·5	17·0	76·0
May (1906) - - - -	38	69·8	51·3	18·5	78·0
June - - - -	30	79·2	63·5	15·7	75·0
July - - - -	12	75·2	57·6	17·6	73·4
August - - - -	19	74·7	60·9	13·8	73·9
September - - - -	31	77·5	63·9	13·6	70·6
October - - - -	48	71·8	52·3	19·5	73·0
November - - - -	86	68·6	49·9	18·7	77·0
December - - - -	19	65·5	39·8	25·7	76·4
Total - - - -	416	70·4	51·7	18·7	75·6

Averages for year.

B.—DRY SHEDS: MONTHLY AVERAGES.

Month.	Number of Sheds Tested.	Inside Temperatures.	Outside Temperatures.	Excess of Inside over Outside Temperature.	Percentage of Humidity in Sheds.
January (1907) - - - -	29	65·2	45·7	19·5	60
February - - - -	15	64·3	40·1	24·2	—
March - - - -	29	67·7	48·7	19·0	—
April - - - -	31	68·4	51·6	16·8	67
May (1906) - - - -	5	67·4	51·2	16·2	—
June - - - -	6	73·0	62·6	10·4	—
July - - - -	—	—	—	—	—
August - - - -	2	81·5	66·0	15·5	—
September - - - -	2	77·5	63·0	14·5	—
October - - - -	4	67·8	47·7	20·1	70
November - - - -	7	65·6	50·3	15·3	—
December - - - -	25	64·4	34·8	29·6	—
Total - - - -	155	67·0	46·8	20·2	66

Averages for year. 4 readings only.

C.—DRY SHEDS, SEPTEMBER-DECEMBER, 1907.

Month.	TEMPERATURES.				HUMIDITIES.			
	Number of Sheds Tested.	Inside.	Outside.	Excess of Shed over Outside Temperature.	Number of Sheds Tested.	Inside.	Outside.	Deficiencies of Inside Humidities compared with Outside.
Sept. - -	16	73·9	64·3	9·6	—	—	—	—
Oct. - -	5	69·0	55·4	13·6	1	53	—	—
Nov. - -	28	65·6	49·5	16·1	26	67·3	(8 days) 82	14·7
Dec. - -	24	64·0	40·4	23·6	24	64·0	(3 ") 92	28·0
Total -	73	67·2	50·2	17·0	Total, 51	65·5	84·7	19·2

Average. Average.

Reference (2).
At the higher temperatures there is decidedly a sense of discomfort, as I can personally testify, but there are certain impressions as to the effects of working in humid places which are erroneous. One in particular is a supposition as to a condition of saturation of clothing which occurs through its absorbing humidity from the atmosphere. This saturation is due not so much to deposition of moisture from the atmosphere as to perspiration. Certain experiments have been made on this subject:—
1. Vicuna coat weighing 2 lbs. 7½ ozs., thoroughly dried, exposed in dense steam, humidity 100 per cent. (dry reading 61° F.).
As worn. Increase on dry weight 1·27 per cent.
After 1 hour. " " " 3·82 "
" 2½ hours. " " " 5·73 "
2. Blue serge trousers weighing 1 lb. 15 ozs., thoroughly dried, exposed in dense steam, humidity 100 per cent. (dry reading 61° F.).
As worn. Increase on dry weight 1·61 per cent.
After 1 hour. " " " 3·22 "
" 2½ hours. " " " 4·84 "
3. Vicuna coat as in experiment 1, thoroughly dried, exposed in steamy atmosphere, humidity 92 per cent. (dry reading 56° F.).
After 3½ hours—Increase on dry weight 1·91 per cent.
4. Blue serge trousers as in experiment 2, thoroughly dried, exposed in steamy atmosphere, humidity 92 per cent. (dry reading 56° F.).
After 3½ hours—Increase on dry weight 2·42 per cent.
6. Shawls dried thoroughly and exposed for 10744 hours in shed (Matthews & Yates' humidi-

fiers), humidity 88 per cent. (dry reading 68° to 70° F.).
Shawl A, weighing 1 lb. 13½ ozs., increase on dry weight 3·4 per cent.
Shawl B, weighing 2 lbs. 1½ ozs., increase on dry weight 5·22 per cent.
Shawl C, weighing 1 lb. 14 oz., increase on dry weight 3·33 per cent.
Also a piece of taper's flannel weighing 4 lbs. 4 ozs., taken from office (and therefore undried) to shed, increased under identical circumstances 73 per cent.
6. Shawls dried in moderately steam-heated cloakroom for three hours, exposed for 2½ hours under circumstances as in experiment No. 5, but in shed with Hart's humidifiers:—
Shawl D, weighing 2 lbs. 2 ozs., increase 1·47 per cent.
Shawl E, weighing 3 lbs. 1 oz., increase 2·55 per cent.
7. Shawls dried and exposed as in experiment No. 6, but in shed humidified with "Drosophores"—
Shawl F, weighing 3 lbs. 0 ozs., increase 1·04 per cent.
Shawl G, weighing 3 lbs. 2 ozs., increase 2·04 per cent.
These experiments indicate that a dried garment will not absorb more than about 5 per cent. of moisture under the most humid conditions, and that when in a condition as worn it will not absorb more than about 1 per cent. The exception is shawl B. This was, however, hung on a pillar, whereas in all other cases lines or inside walls were utilised. This points to what is common knowledge, that condensation of

moisture occurs on pillars and outside walls. It is difficult to avoid using such places, and therefore the provision of proper cloakrooms (*i.e.*, heated, under lock and key, and with sufficient spaces between pegs) should be extended to all humid weaving sheds.

Taper's flannel is a mixture of cloth and wool. The piece referred to in experiment No. 5 was hung against a pillar; another piece, weighing 9½ lbs., also on a pillar, gained 64 per cent., but a further piece weighing 6½ lbs., on an inside wall, gained only 48 per cent.

It has to be borne in mind that the warp contains deliquescent matter, and that the fact of a warp absorbing moisture does not mean that clothes are necessarily damped to a similar extent.

Water for raising steam.—Particularly in Blackburn there has been a reversion to the use of steam from the ordinary power boiler. The small evaporators which were fixed are in practically all cases now disused. The reasons given are:—

1. Difficulty of feeding under pressure as injectors are not fixed, and the pressure of town's supply is not sufficiently great.

2. That the canal or other water used in the power boilers satisfies a provisional standard which was suggested.

3. Danger of explosion. (An evaporator burst, but I believe it had not been examined; nevertheless the idea is very prevalent that these evaporators are not safe.)

On general grounds I consider that the use of town's water, evidently intended by Section 94 (1) of the Factory and Workshop Act, 1901, should be required.

Reference (3).

Whitewashing of roofs.—The period for maintaining this covering on the roofs should at least extend from the middle of May to the middle of September.

Water spray and steam humidification.—The theoretical cooling effect of diffusing water instead of steam into a shed atmosphere is not realised in practice.

Table F gives:—

Monthly and yearly average inside temperatures; and

Excess over outside temperatures for seven forms of apparatus.

The period from May to September is the most trying in humid sheds, and I have therefore given averages for these months as well as for the year. The yearly average humidity and CO₂ for each apparatus are given below.

	Number of Tests.	Inside Temperature.	Percentage of Humidity.	CO ₂ (parts per 10,000).
Fans and Steam Pipes - - - - -	283	69.7	76.0	9.13
Hart's - - - - -	74	73.9	73.5	7.10
Parsons - - - - -	37	69.6	76.5	8.90
Pye's - - - - -	10	71.0	78.5	9.20
Matthew and Yates - - - - -	7	69.6	74.1	7.50
Howorth's - - - - -	9	69.1	73.8	8.60
Mather and Platt's (Vortex) - - - - -	4	70.6	74.8	8.70

From these tables it will be observed that Hart's apparatus, whilst holding the premier position as a ventilating machine, is the one which raises the temperature to the highest point.

Howorth's and Mather & Platt's machines are the principal water sprayers, but the latter is only at present in a limited number of places, and, so far as I know, only new mills. Therefore a proper comparison of its value is difficult to make.

Hall & Kay's apparatus is fitted in several places in the Manchester C. C. F. District. Twelve tests in May and June, 1907, gave the following figures:—

Average Temperature.	Average excess over outside temperature.	Average Humidity.	Average CO ₂ .
72.4°	12.8°	71.3%	7.2

From observation and inquiry I consider that between 2°–3° decrease in temperature may be obtained by use of water sprays, as compared with steaming systems.

In two tenements in the same factory I found the underneath readings:—

		Hart's.	Mather & Platt's (Vortex).
6–9–1906	Side	76.0°	75.0°
	Centre	77.0°	75.5°
25–2–1907	Side	68.0°	66.0°
	Centre	70.0°	66.0°

I have also examined the records of a new mill fitted with Mather and Platt's apparatus, and found the highest record this year was between 3–4 p.m. on 13th August. The readings were 78° dry and 72½° wet.

Steam-pipe coverings.—A reduction in shed temperatures could be effected by stricter methods in dealing with these. A covering costing 4½d. per square foot of external surface (practically the same as per foot run) is generally supplied. A more effective coating is possible. At a particular mill I had a small portion covered with a magnesia compound

and obtained a reduction in the surface temperature of from 6°–8°.

The portions below the jets are usually left bare, and these add up to a considerable length per shed. They should be covered, drain pipes or detachable portions similar to flange covers being supplied for dealing with leakage. The necessity for these parts being left exposed appears to be somewhat exaggerated.

The jets themselves are usually 6 inches to 9 inches long, and are uncovered—the use of dwarf jets would probably be more convenient than coating the long jets.

A standard for pipe coverings is most desirable. One of surface temperature alone appears possible, as the water condensation test or the electrical method of heating cannot well be applied.

Experiments under exact and controllable conditions are necessary to determine what is a reasonable figure. I have endeavoured to get some data, but there are difficulties in the way of successfully making such tests in working factories. In testing I have fixed a thermometer horizontally on the pipe covering, with the bulb ¾-inch above the surface. The bulb has not been protected from air currents in any way, but I have avoided the vicinity of fans. The temperatures obtained varied from 75° F. to 112° F., the average for 33 tests being 90.3° F. The maximum difference between shed and surface temperatures was 38.5°, minimum 10°, and the average 21.3°.

The practical difficulties in the way of experimenting are principally the varying amounts of steam passed and the uneven surfaces of many of the covers. A smooth surface would facilitate testing, and also probably reduce the amount of heat radiated. I think it would therefore be advisable to lay down that a smooth finish should be given to all coverings.

I made some tests on the same pipes on different days when the shed temperatures varied, with the following results:—

D.

Shed.	Shed Temperature.	Covering Temperature.	Difference in	
			Shed Temperature.	Covering Temperature.
A - - - - }	80·0	105		
	60·0	94	— 20·0	— 11
B - - - - }	73·5	112		
	70·0	93	— 3·5	— 19
C - - - - }	76·0	100		
	66·0	82	— 10·0	— 18
D - - - - }	74·0	100		
	62·0	90	— 12·0	— 10
E - - - - }	80·0	100		
	70·0	85	— 10·0	— 15
F - - - - }	71·5	89		
	66·0	95	— 5·5	+ 6
G - - - - }	73·5	90		
	63·0	82	— 10·5	— 8
H - - - - }	72·0	102		
	61·0	92	— 11·0	— 10

The discordant results probably illustrate the effect of uneven coverings and air currents. Within the narrow limits which obtain the influence of shed temperature might, perhaps, be assumed to be additive, and an empirical formula used as a standard. The formula might be:—Difference between shed temperature and surface temperature (in F°) x circumference of surface of covered pipe (in inches) not to exceed a constant: (on the results of my experiments this might be 240). The difference between the external steam-pipe diameter and the diameter of the covered pipe to be at least 2½ inches, and any shed temperature below 70° F. to be reckoned as 70° F.

Power to require the covering of all pipes (including exhaust pipes) conveying steam or hot water (except those used solely for warming purposes) should be given.

MAXIMUM PERMISSIBLE PERCENTAGE OF HUMIDITY.

Table E gives—

Average monthly and yearly inside temperatures.

Average monthly and yearly percentages of humidity found.

Maximum percentage of humidity permissible at average temperatures.

Margin between permissible humidity and humidity found.

E.

Month.	Number of Sheds Tested.	Dry Temperature in Shed.	Percentage of Humidity		
			Found.	Permissible.	Margin.
January (1907) - - - -	38	66·4	78·0	88·0	10·0
February - - - - -	8	64·5	72·8	88·0	15·2
March - - - - -	25	67·2	77·5	88·0	10·5
April - - - - -	62	68·5	76·0	88·0	12·0
May (1906) - - - - -	38	69·8	78·0	88·0	10·0
June - - - - -	30	79·2	75·0	77·5	2·5
July - - - - -	12	75·2	73·4	81·0	7·6
August - - - - -	19	74·7	73·9	81·5	7·6
September - - - - -	31	77·5	70·6	78·0	7·4
October - - - - -	48	71·8	73·0	84·0	11·0
November - - - - -	86	68·6	77·0	88·0	11·0
December - - - - -	19	65·5	76·4	88·0	11·6
Total - - - - -	416	70·4	75·6	84·0	8·4

Yearly average.

The question arises as to whether some reduction in the maximum permissible humidity at the higher temperatures can be made. Except for the month of June there is a wide margin, and even there a reduction of ½° could be made. The sampling in June and July appears to have been on such days as to reverse the usual conditions of temperature. Table A shows temperatures of May, June, and July, as 51·3°, 63·5°, and 57·6° respectively, whereas published records show a progressive increase of 4°·5°. It must be remembered, however, in considering this

matter that the summer of 1906, as well as the present one, was below the average of temperature. The Blackburn C. C. F. District Report for 1906 shows that 96 excesses of humidity were found in that year. The district contains 505 humid rooms. The proportion of 20 per cent. appears high, but in practically every case excess is due to inattention. I only recollect two cases in the course of 15 months' inspection where it was alleged that difficulty existed in keeping within the limits.

F.—COMPARISON OF HUMIDIFYING APPARATUS.

Month.	Fans and Steam Pipes.		Hart's.		Parson's.		Pye's.		Mathews and Yates'.		Howorth's.		Mather and Platt's (Vortex).	
	Inside Temperature.	Excess over Outside Temperature.	Inside Temperature.	Excess over Outside Temperature.	Inside Temperature.	Excess over Outside Temperature.	Inside Temperature.	Excess over Outside Temperature.	Inside Temperature.	Excess over Outside Temperature.	Inside Temperature.	Excess over Outside Temperature.	Inside Temperature.	Excess over Outside Temperature.
January (1907)	66.2	22.8	70.7	22.7	68.0	23.0	62.0	27.0	—	—	—	—	—	—
February	61.0	26.0	67.0	31.0	58.0	28.0	—	—	—	—	—	—	66.0	24.0
March	66.5	21.2	68.3	24.7	72.0	19.0	—	—	—	—	—	—	—	—
April	68.1	16.0	71.3	22.3	68.5	19.5	72.0	17.0	65.5	22.5	69.3	14.3	—	—
May (1906)	69.0	18.6	71.1	19.0	—	—	74.0	19.0	69.0	13.0	—	—	69.0	14.0
June	79.6	13.9	79.5	19.8	—	—	79.0	9.0	67.0	9.0	—	—	—	—
July	74.7	16.7	75.4	17.6	—	—	77.0	23.0	—	—	—	—	—	—
August	74.0	13.2	77.5	16.5	—	—	—	—	—	—	—	—	—	—
September	76.6	12.3	80.0	16.3	78.0	15.0	—	—	—	—	74.0	13.0	75.5	12.5
October	71.0	18.2	71.0	19.8	74.0	22.5	75.5	24.5	76.0	20.0	—	—	—	—
November	68.0	18.4	71.0	19.4	68.9	21.2	—	—	72.0	21.0	68.0	18.4	72.0	11.0
December	65.4	24.6	—	—	65.8	28.2	—	—	—	—	—	—	—	—
Average	²⁸³ 69.7	18.0	⁷⁴ 73.9	19.8	³⁷ 69.6	22.2	¹⁰ 71.0	21.3	⁷ 69.6	18.5	⁹ 69.1	16.4	⁴ 70.6	15.4
May to Sept.	⁸⁰ 74.4	15.0	⁴¹ 76.5	18.2	¹ 78.0	15.0	³ 76.6	17.0	² 68.0	11.0	¹ 74.0	13.0	² 72.2	13.2

Small numbers in italics indicate number of readings.

Reference (4).

The table annexed gives the average volumes per 10,000 of CO₂ found in the air of dry sheds during the year May, 1906—April, 1907, and also for comparison the volumes found similarly in humid sheds.

G.—CO₂ (VOLUMES PER 10,000).

Month.	Dry Sheds.		Humid Sheds.	
	Number Tested.	Result.	Number Tested.	Result.
January (1907)	29	14·7	38	10·4
February	15	17·2	8	8·2
March	29	11·5	25	9·3
April	31	11·0	62	9·0
May (1906)	5	8·6	38	7·3
June	6	9·6	30	7·6
July	—	—	12	8·4
August	2	10·7	19	7·3
September	2	9·7	31	7·3
October	4	12·9	48	8·3
November	7	17·6	86	9·2
December	25	20·2	19	11·0
Total	155	Average 14·6	Total 416	Average 8·7

The comparative averages of 14·6 and 8·7 for Dry and Humid Sheds respectively indicate the necessity for improvement in ventilation in the former. The period from September to April is the one during which ventilation is really bad—during the other months natural ventilation takes place. As the above figures include some repeat visits to sheds where mechanical ventilation has been introduced; they probably present an aspect better than is really the case when the whole of the sheds are considered.

The Blackburn C. C. F. District Report for 1906 mentions 73 cases during that year exceeding 12 volumes per 10,000, divided as follows:—

10-15 vols.	15-20 vols.	20-30 vols.	Over 30 vols.
17	24	23	9

The introduction of mechanical ventilation into dry sheds is highly desirable, as, apart from decreasing the amount of carbonic acid, it reduces the temperature in the summer and during the time when gases have to be lit in the dark weather. Propelling fans with heating coils will also warm the sheds more rapidly in the morning than ordinary steam pipes. It has been urged that such ventilation is impracticable on account of the bad effect of introducing cold dry air during the winter. Be this so or not, it is the fact that practically all mechanical ventilation is suspended in winter, sooner or later, as far as dry sheds are concerned. To investigate this point I visited several sheds on December 4, 5, 6, and 7. South or westerly winds were blowing on these days,

but they were fairly cold, the outside temperatures being 42·5°, 39·7°, 40°, and 38°. Rain was falling on each day—very heavily on the 4th inst. The outside humidities were 92 per cent., 90 per cent., 92 per cent., and 100 per cent. respectively.

I visited 28 sheds provided with fans, 5 making coloured goods and 23 plain. In all the coloured places the fans were running, and in 12 plain sheds. At the 11 places the fans were stopped for the following reasons:—

Propelling fans, no steam coils	4
Propelling fans, defective coils	2
Fans badly fixed	2
Draughts	3

11

At only one place (a plain shed where the fans were running) was it said that the fans affected the weaving, though I specially enquired on this point.

Temperatures and Humidities on 4th, 5th, 6th, and 7th December.

	Inside Temperature.	Percentage Humidity.
9 sheds with fans running	66	62·5
13 sheds with fans stopped or ventilated naturally	62·6	64·8

The whitewashing of roofs should also be made obligatory in dry sheds, on the same lines as in humid sheds.

APPENDIX III.

SUMMARY OF EVIDENCE by J. S. HALDANE, M.D., F.R.S., Fellow of New College and Reader in Physiology, University of Oxford.

My attention was drawn to the effects on men of warm and moist atmospheres by enquiries on which I was recently engaged for the Home Secretary on the Health of Cornish Miners and on Factory Ventilation, and I have made numerous experiments and observations on this subject, partly in artificially-heated rooms and partly in mines or factories.*

These experiments proved that in very warm air it is the temperature indicated by the wet bulb thermometer (not the actual air temperature as shown by the dry bulb thermometer, nor the amount of

moisture in the air, nor the relative humidity) which determines the ill-effects produced. With a wet bulb temperature exceeding 88° to 90° in fairly still air the body temperature begins to rise, even in the case of persons stripped to the waist and doing no work; and when once started this rise continues until symptoms of heat-stroke arise, unless the person leaves the warm air. In the case of persons doing muscular work, the rise of body temperature is much more rapid and begins at a much lower wet bulb temperature. It will, for instance, begin (in persons stripped to the waist) at a wet bulb temperature of about 80° in still air with moderately hard muscular work, so that hard and continuous work is impracticable at wet bulb temperatures of over 80° in still air. There is no doubt that when ordinary clothes are worn, serious rise of body temperature occurs at a still

* These observations, so far as published, and the conclusions drawn from them, will be found in the Report on the Health of Cornish Miners (Parliamentary Paper, 1904, p. 93); in a paper on "The Effects of High Air Temperatures," Journal of Hygiene, 1905, p. 494; and in the Second Report on the Ventilation of Factories (Parliamentary Paper, 1907, p. 6).

lower wet bulb temperature. Soldiers marching in uniform are, for instance, liable to heat stroke at wet bulb temperatures of under 70° .

Under Schedule 4 of the Factory Act, wet bulb temperatures of over 90° are permitted. This schedule greatly requires revision. It doubtless gives rise to the impression that a wet bulb temperature of 20° or even 10° below the maximum specified cannot cause harm or inconvenience to workpeople. To prevent serious discomfort to workpeople the maximum rise of wet bulb temperature in humidified cotton cloth factories would need to be limited to a much lower point.

I think that it would be desirable, if possible, to fix this limit at about 70° (wet bulb) for most of the year, allowing, however, an extension to about 75° during the warmer months, from, say, June 1st to October 10th, or on any day when the wet bulb temperature outside exceeds 65° . My reasons for this suggestion are as follows:—

The persons employed in a cotton cloth factory wear ordinary clothing, and go to and from their meals in this clothing. It is evidently desirable that they should not get wet from perspiration during their work, and in this respect they are in a different position from miners, who can strip during their work, and rest if they get too hot. With a view to my evidence before this Committee, I have recently made some experiments on the effects of moderate heat and moisture on persons wearing their ordinary indoor clothing. I found that in fairly still air* and with a wet bulb temperature exceeding about 70° , and with muscular exertion, comparable to that needed in managing looms, the skin and clothes became damp and uncomfortable from perspiration when ordinary indoor clothing was worn. There was little or no discomfort if the wet bulb was below 70° . The effect seemed to be the same whether the temperature by the dry bulb thermometer rose or fell, provided the wet bulb temperature was the same, whereas any rise in the wet bulb temperature above 70° very rapidly increased the effect. With lighter clothing, such as would be worn indoors in summer, a wet bulb temperature of 3 or 4 degrees higher was needed to produce the same effect; and for this reason, and in view of the difficulty of controlling rise of temperature in weaving sheds in summer, I think that the higher wet bulb temperature should be allowable in summer, although a wet bulb temperature below 70° would at all times be preferable.

I am not aware of any *serious* injury to health from working in warm or moist air, provided that any considerable rise of body temperature is avoided. Miners working in warm and moist air do not seem to be injured in health, although, of course, their working capacity in such air may be diminished almost to a vanishing point. Persons going to and from their work in clothes wet with perspiration must, however, be liable to "chills." It is chiefly because of the discomfort, dirt, and untidiness caused by constant perspiration, that I think it desirable to keep the wet bulb temperature below 70° . I have hitherto had no opportunity of seeing Lancashire weaving sheds during warm weather in summer, but I have seen humidified flax spinning rooms in Belfast during hot weather, with wet bulb temperatures of about 80° . I was greatly impressed by the uncomfortable and bedraggled appearance of the women employed; they were wet from perspiration and from the wet spinning, and, had they worn overalls to protect themselves against the spray from the spinning, they would only have got still wetter from perspiration and probably have run the risk of heat-stroke.

I understand that the evidence before the Committee shows that wet bulb temperatures of more than about 65° are not needed for weaving, so that any objection to limits, such as I have suggested, could only arise from the difficulty of keeping the temperature so low as would correspond to the limits suggested without the air becoming too dry, *i.e.*, of preventing the difference between the wet and dry bulbs exceeding 4 or 5 degrees.

* With the air in motion a higher wet bulb temperature was required to produce the same effect; and, if the air of a weaving shed were kept in motion by fans, a higher limit of wet bulb temperature could be borne without discomfort.

If the method of simply mixing steam with the incoming air is adopted in warm weather, it seems impossible to maintain a reasonably low temperature (wet bulb) in a shed without allowing the air to be too dry. The addition of steam will, at the best, slightly warm the air in addition to moistening it, and if, as often happens in summer, this air has already a temperature exceeding 80° , it cannot be sufficiently humidified by steam without raising the wet bulb temperature inside the shed to a quite unbearable extent. The quantity of water and steam consumed is also very serious. It seems to me that in hot weather the proper method of producing the requisite degree of humidity in the air is to lower the dry bulb temperature to near the wet bulb temperature, and not to raise the wet bulb temperature to near that of the dry bulb, as in the steaming method. The end in view can be attained by passing the air through an arrangement which will saturate it with aqueous vapour by evaporation. It will then arrive in the shed at a greatly reduced temperature, owing to the cooling effect of evaporation. Not only will its dry bulb temperature be greatly reduced, but its wet bulb temperature will not be increased, and may be slightly lowered, in spite of the increased amount of moisture that the air carries. If, for instance, the outside air had a temperature of 90° , with a wet bulb temperature of 70° , this air could be cooled to about 70° by passing it through a saturating arrangement, the wet bulb temperature being now about 69° . In passing through the shed, the air would be warmed several degrees by the heat from moving machinery, etc., and from the roof and walls, but with a sufficient air current the wet bulb temperature could be kept below 75° , with the dry bulb 5 or 6 degrees higher. I assume, of course, in making this calculation, that the roof is properly constructed so as to prevent any unusual conduction of heat from the sun's rays, and that the windows face in a more or less northerly direction. With this arrangement a considerable saving of water could be effected, and no steam would be needed in warm weather, although the percentage relative humidity of the air would be much higher than would have been practicable had steaming been employed. In other words, the saturating arrangement by evaporation would be much better for both the comfort of the workpeople and the efficiency of their work, and would at the same time be cheaper.

If the saturating arrangement were adopted in winter, in place of steaming, the incoming air would need to be heated before passing through the saturator, so that no saving in steam or water would be effected. Saturators by evaporation would only need to be used when the air temperature exceeded about 60° , and could be placed on the roof above each air inlet.

The amount of cooling in the incoming air produced by an efficient evaporation saturator would be equivalent, roughly speaking, to the difference between the dry and wet bulb temperature of the outside air. In hot weather this difference is large, commonly about 15 to 20 degrees; in cool and damp weather it is, of course, very small. The actual temperature of the shed will depend, not merely on the temperature of the incoming air, but on the amount of ventilation as compared with the production of heat in the shed by friction of machinery, heat from persons, and gain or loss of heat through roof and walls. The production of heat in the shed can be roughly calculated from the horse-power absorbed in driving the looms, and from the number of persons present; and this should afford some guidance as to the amount of ventilation required under given conditions of weather. In summer weather this ventilation certainly requires to be very free, but in cold weather, when steaming and artificial heating are employed, equally free ventilation would be wasteful of steam and heat, and an ordinary standard of ventilation would be sufficient.

With regard to ventilation of non-humidified textile factories, I think this is often unsatisfactory at present, the consequence being that—(1) the wet bulb temperature may rise too high in summer weather, and (2) a reasonable chemical standard of purity in the air is not maintained. I understand that the chief difficulty of providing a more free ventilation is that the air may be rendered too dry for weaving,

whereas, if light steaming were resorted to, the persons employed might object, and the factory would come under the restrictions applied by the Factory Act to humidified factories. As a member of the late Home Office Committee on Factory Ventilation, I concurred in recommending that a maximum of 12 volumes of CO₂ per 10,000 should be taken as the legal maximum in all factories; and, considering that the textile industry is not unhealthy, except in dusty processes, and that there is no approach to overcrowding, we did not recommend any stricter standard for this industry. This standard permits of the addition of a very appreciable amount of moisture to the air by natural and unavoidable means, and were it adopted, no artificial moisture might be needed for weaving. I think, however, that light steaming with pure steam, or light humidification by evaporation of water, to the extent of say 65 per cent. humidity, might also be permitted, provided a wet bulb temperature of 70° were not exceeded by such means, and that a wet bulb temperature of 75° were avoided at all times.

In suggesting 75° as a maximum allowable limit

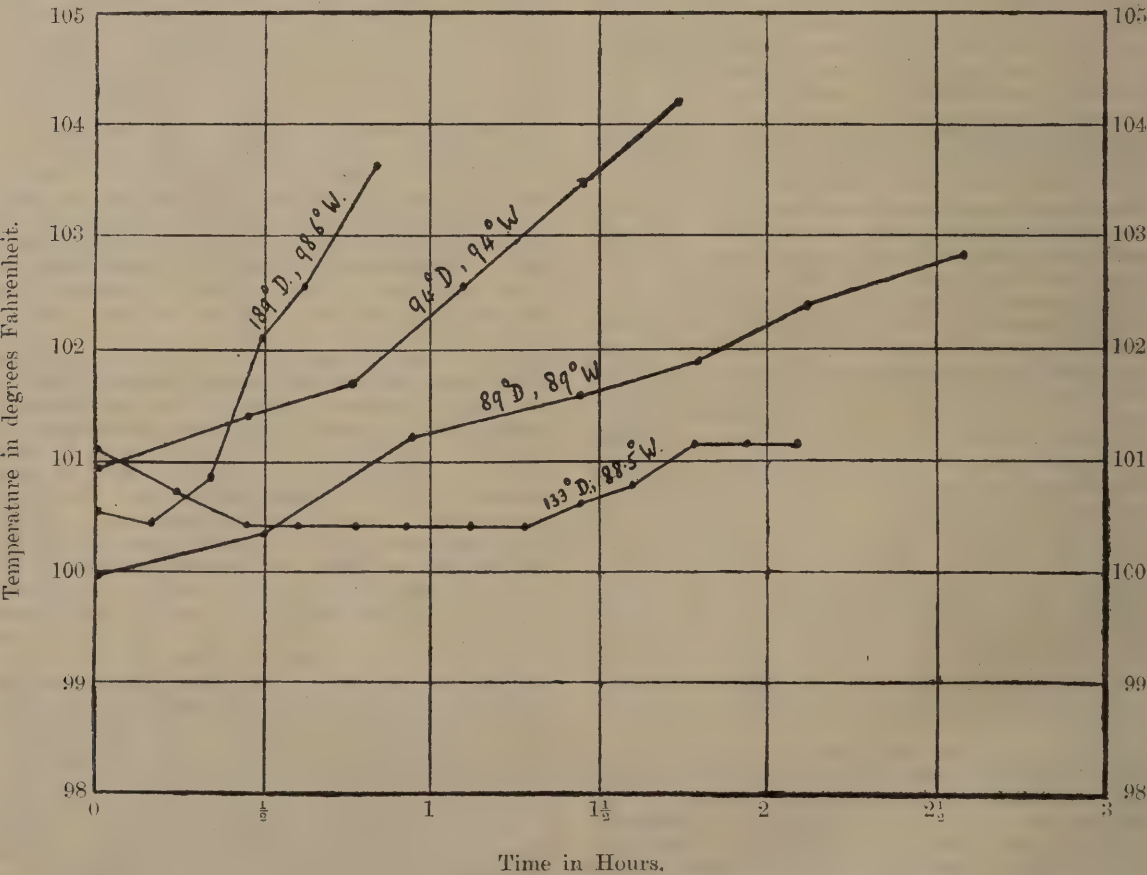
of wet bulb temperature in humidified factories between June 1st and October 10th, I have borne in mind climatic conditions, so far as my information on the subject goes. On searching through the hourly records of wet and dry bulb temperatures at the Radcliffe Observatory, Oxford, I have only found two days in the records of ten years, on which the wet bulb temperature temporarily exceeded 70° in the afternoon, and five days on which it exceeded 69°. I do not know whether the wet bulb air temperature ever reaches 70° in Lancashire, but I think that on any such day some allowance might be made for the difficulty in keeping the wet bulb temperature in factories below 75°. Between October 10th and June 1st, the hourly records showed no higher wet bulb temperature than 63° at any time, but in the first week in October there was on one occasion a wet bulb temperature of 67°, and some of the highest wet bulb temperatures occur in September.

In sheds which are so constructed that neither the ventilation nor whitewashing the roof will keep the wet bulb temperature below 75° in summer recourse could be had to watering the roof on hot days.

APPENDIX IIIA.

(Questions 3102, et seq.)

VARIATIONS OF RECTAL TEMPERATURE DURING REST, AND STRIPPED TO THE WAIST AT VARIOUS AIR TEMPERATURES.



D = dry bulb air temperature.
W = wet " " "

APPENDIX IV.

EPITOME OF EVIDENCE by M. S. PEMBREY, M.D., Guy's Hospital, London.

For a considerable number of years I have studied the effects of temperature and muscular work. My experience of the effects of warm and moist atmospheres upon men has been gained from observations upon myself, soldiers, and medical students. Apart from the scientific interest of the question, the practical object has been to determine the effects of marching and other forms of work under different conditions. The results show definitely that a man is much less efficient in a warm moist atmosphere. Temperature indicated by the wet bulb thermometer and wind are the most important atmospheric conditions. The effects were studied by determinations of the internal and surface temperatures of the body, the pulse, blood-pressure, respiration, loss of moisture from the body, and retention of moisture in the clothes. A man can do far more work with less fatigue at a low wet bulb temperature than at a high one. It is, in my opinion, to the advantage of both employer and employed that the work in weaving factories should be performed at temperatures below 70° Fahr. by the wet bulb; at the lower tem-

peratures work could be done at a faster rate, more efficiently and with less fatigue, discomfort, and injury to health. The effect of work in a warm, moist atmosphere is to increase the temperature, pulse, and loss of moisture out of proportion to the work done.

Efficient work cannot be performed, unless the temperature of the body is prevented from rising above a certain optimum. The temperature depends upon the production and loss of heat; work increases the production, and the passage of more blood through the blood vessels of the skin and the evaporation of sweat increase the loss. A warm, moist atmosphere hinders the loss and taxes the power of accommodation of the worker. The result is that he either does less work, or unwisely neglects the warning he receives from his sensations, and works at an uneconomical rate to the detriment of his health. The result of the latter condition has been the death of thousands of soldiers from heat-stroke.

The influence of temperature and moisture is shown by the following examples:—

External temperature.		Pulse.			Rise in internal temperature.			Loss of moisture in grams.			Increase in weight of clothes.		
D.B.	W.B.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
79.0	67.5	84	52	62	2.3	0.6	1.4	2390	1140	1816	640	60	320
69.0	59.0	48	46	47	1.8	1.2	1.0	1850	1200	1600	480	122	354
45.0	38.0	24	8	14	1.6	0.0	0.8	555	300	419	40	0	27

The work was the same in each case.

If there be wind, a higher wet bulb temperature can be borne.

Constant exposure to a hot, moist atmosphere has a bad effect upon the growth and nutrition of English children. These effects can be diminished by light clothing, bare legs and arms, whereby the loss of heat from the skin is increased.

By practice a certain amount of accommodation to the effects of a hot, moist atmosphere is acquired, but it is strictly limited; it depends in great part upon the reduction of the muscular effort to the minimum necessary for the performance of the work.

As regards the question of the standard for the amount of carbon dioxide in the air of the humid weaving sheds, I see no objection to raising it to 12 vols. per 10,000, provided that the temperature of the air by the wet bulb thermometer is lowered below 70° Fahr.

One cannot detect any bad effect from 60 vols. per 10,000, when the temperature of the room is low.

Too much stress has been laid upon the question of carbon dioxide; its presence has been used as a test for defective ventilation, and in this way the mistake has arisen of considering it the injurious factor. All recent investigations in this country, on the Continent, and in America, show that temperature, moisture and wind are the most important factors in connection with the injurious effects of badly ventilated rooms.

The important thing is to keep the wet bulb temperature low, and to prevent the air from becoming stagnant and uniform in temperature.

It is necessary to take a reasonable standard and to allow for natural variations in the atmosphere in summer and winter. The wet bulb in September may be for outside air as high as 67° Fahr.; the carbon dioxide during a fog may be 10 to 14 vols. per 10,000 in the outside air. During this winter it was 10 vols. per 10,000 in the outside air in the grounds of Guy's Hospital on a foggy day.

APPENDIX V.

EPITOME OF EVIDENCE of A. E. BOYCOTT, M.A., M.D., Fellow of Brasenose College, Oxford, and Lecturer on Pathology in Guy's Hospital.

I have had no personal experience of the conditions of work in humidified cotton factories; any evidence, therefore, which I have to offer must be in relation to the general question of the pathological effects of hot moist air and of carbonic acid upon man. My own experience of the effects of hot moist air has been derived from laboratory experiments and from observing the influence on myself and others of the conditions obtaining in mines.

Hot dry air (over 75° Fahr. dry bulb), especially if still and free from currents, produces a well-known feeling of "slackness," and I have found that this is associated with a distinct fall of blood-pressure. The important element seems to be the skin sensations, and draughts are to a great extent capable of restoring a feeling of liveliness. With a healthy man, at rest and lightly clad, the temperature of the body is not altered. Whether any definite pathological effects are produced is doubtful; but the diminution of mental and physical energy is of importance.

If hot air is at the same time moist, much more serious effects may be produced. These effects are directly dependent on the absolute reading of the wet bulb thermometer, and are relatively independent of the dry bulb temperature. At rest and stripped I found that my body temperature rose rapidly if the wet bulb exceeded 88°-90° Fahr. with a dry bulb of about 100°, though no rise occurred with a dry bulb of 110°, and a wet bulb of less than 85°. I have on many occasions spent periods of about an hour in doing ordinary laboratory work in air with the dry bulb at 95° and the wet bulb at about 65° without any material discomfort. If, however, the wet bulb rises to 88°-90°, one's body temperature soon begins to go up even when completely at rest, and one becomes exceedingly uncomfortable and on occasions feels very ill. These sensations can be, to some extent, remedied by local cooling of the skin (*e.g.*, cold water on the head), but the rise of body temperature is progressive and must eventually end in heat-stroke.

The effects are much exaggerated by muscular work. With fairly active work in walking about in a Cornish mine, I have been reduced to a profound degree of exhaustion in air saturated with moisture and varying from 78° to 93° Fahr. Moderate work causes the body temperature to rise quickly with a wet bulb temperature of much less than 88°, 75° Fahr. is sufficient under these circumstances to produce an unpleasant rise. Severe work, of course, raises the body temperature considerably under any circum-

stances of air temperature. The rise accompanying vigorous outdoor exercise does not, however, usually cause particularly unpleasant sensations owing to the fact that the wet bulb temperature is generally sufficiently low, and the clothing appropriately adjusted, to allow sweat to evaporate freely and so cool the skin.

There is some evidence that persons habitually working in wet bulb temperatures of *e.g.* 85° may become accustomed to the conditions in so far that their body temperature does not rise so readily. My observations on miners, however, lead me to conclude that their power of doing work under these circumstances is quite small. It also appears to be hardly possible that a rise of body temperature of 2 or 3 degrees can be experienced daily over long periods of time without some detriment to health. The ill effects of exposure to cold after being in hot places are, I believe, a good deal exaggerated.

From these considerations, therefore, I am of opinion that operatives should not be called upon to work with a wet bulb of above 75° Fahr., and that it would be desirable, though perhaps not always practicable, that the upper limit for active work should be 70° Fahr.

The question of raising the permissible limit of CO₂ from 0.09 to 0.12 per cent. seems to me to depend almost entirely on considerations of what is practicable. It is desirable that the air in the weaving sheds should approximate as closely as possible to the composition of pure outside air in its content of CO₂, not because 0.1 per cent. or even 1 per cent. of CO₂ is in any way hurtful, but because the CO₂ gives the best available index of the extent to which the air is vitiated by the products of manufacturing processes, the combustion of gas, or by the micro-organisms and unpleasant smells arising from human beings. The free ventilation required to keep down the CO₂ is of value not only by preventing the accumulation of these bodies, but also by producing currents of air of varying temperatures. Apart from smell, the essential difference between a "fresh" and a "stuffy" room is that in the former the air is not all at the same temperature, but is broken up by draughts which impinge on the hands and face, lower the skin temperature, and so produce a feeling of loveliness. The qualities of freshness and stuffiness in a building, and in consequence the energy or slackness of the inhabitants, has nothing to do with the content of the air in CO₂ as such. Cold air, free from unpleasant smell, but containing 3 per cent. of CO₂, I have found to be a distinctly invigorating mixture.

APPENDIX VI.

SUMMARY OF EVIDENCE by LEONARD HILL, M.B., F.R.S., Lecturer on Physiology, London Hospital Medical College.

I have given particular attention to the effect of warm moist atmospheres and the influence of increased partial pressures of carbonic acid on man, in connection with my researches on caisson sickness, and in connection with the perfection of breathing apparatus for the saving of life in mines. The loss of heat from the body is a problem of great complexity and one which has been investigated only in part under the varying combinations of atmospheric conditions, such as stillness and motion, dryness and humidity, warmth and cold, and with the body clothed and naked. Such investigations as have been made—in particular by Rubner and his co-workers in Germany—show that the evaporation of water from the body cannot be regarded as being dependent merely on the percentage humidity of the atmosphere. The temperature of the layer of air in contact with the body is a factor of great importance, and thin

clothes and still air under certain conditions of external temperature may favour evaporation, while nakedness and moving air favour conduction and radiation. The heat losing mechanisms of the body are adjustable to varying conditions within wide limits, so that diminished loss by evaporation is compensated for by increased loss by conduction and radiation.

In regard to warm moist air, wherein the conditions pass out of these limits, Dr. J. Haldane has rendered great service in demonstrating that the wet bulb temperature alone determines with certainty the limits of bearable conditions. I agree with all that he said in giving evidence before this Committee, and in particular with the criticisms that he has made on the table which gives the maximum limits of humidity permitted by the Act; to suggest that a wet bulb temperature of 80°-90° Fahr. may be per-

mitted in factories, where men are engaged for hours at work, is absurd.

I have made recently observations on men equipped with the Fleuss Siebe German Breathing Apparatus, who were exposed in a closed chamber to the fumes of a coke brazier and high external temperatures, the air being made dry or moist to imitate such conditions as may occur in mines. The wearing of the dress made the conditions slightly less favourable than those under which Dr. Haldane experimented. With the wet bulb at 85° Fahr., and the man in full dress, the body temperature was 100·6° Fahr.; with the man stripped to the waist and moving a few bricks from one pile to another, the body temperature reached 101·1° Fahr. The body temperatures of the man rose rapidly to 103° Fahr.; when water was sprayed over the walls of the chamber and the wet bulb temperature rose above 90° Fahr.

*Rubner—the most eminent authority in Germany on questions of body heat says that an untrained man can bear in comfort a temperature of 75° Fahr. and 80 per cent. humidity (wet bulb about 70° Fahr.) only when he is quiet. At 73·4° Fahr. and 6 per cent. humidity he found a resting man lost by evaporation† 75 grm. of water per hour, and at 84 per cent. humidity (wet bulb 70° Fahr.), only 19 grm. These figures show how three-quarters of the heat loss must be maintained by conduction and radiation, when the wet bulb reaches 70° Fahr.

In the building of the St. Gothard tunnel the dry bulb temperature rose at times to 30–31° C. (86° Fahr.), and the air was saturated with moisture, Stapff recorded that the workers suffered from weariness, oppression, loss of appetite, and power to work. The symptoms became much less severe with custom, and Stapff found that the workers could stand 3·6° Fahr. higher temperature than he could without rise of body temperature. As the body temperature of those tunnel workers was in most cases not raised, they must have worked very leisurely. Dr. Haldane has pointed out that it is the masters' pockets which suffer under such conditions; the workers avoid the discomfort of over-heating themselves by working very little.

In caisson works the men work in warm, moist and compressed air. Von Schrötter‡ reported that at the Nussdorf caissons in June and July, the air temperature was 66–70° Fahr., and the percentage humidity 81–96·5. Caisson workers have a peculiar pale appearance when they come out of the works, and their clothes are wet, but they keep their health, body weight, number of red corpuscles, and percentage of hæmoglobin, so long as they do not suffer from caisson sickness, the sole cause of which is air embolism resulting from too rapid a decompression. Warm cloakrooms are provided, where the men can change their wet garments, so as to avoid chill.

It is of more importance to most of us that the conditions of our daily life should be comfortable and pleasant, than that life should be a long one under conditions of discomfort. An almost unanimous complaint on the part of the operatives demands, therefore, great attention. The conditions complained of are those produced by rendering the air humid by jets of steam. The steam increases the warmth of the air and so the wet bulb temperature. I agree

with the suggestion of Dr. Haldane that it would be most desirable to replace this method, whenever the external temperature is high, by the method of wetting and cooling the air by evaporation; the vapour then would not be in such a state of condensation and would not wet the operatives so much. I opine that if the operatives did not see the air wetted by jets of steam, they would not complain so much. Every effort should be made, as Dr. Haldane suggests, to keep the wet bulb temperature below 70–75° Fahr.

I understand that the operatives do not complain in sheds where the air is rendered humid by the evaporation of sweat, etc., the ventilation being reduced to, or even beyond, the permissible limits of carbonic acid. I agree with the suggestion that the limit of carbonic acid should be raised to 12 parts in 10,000, as recommended by the Home Office Committee on Factory Ventilation, if this would allow of sufficient humidity to be obtained without recourse to artificial means, and so satisfy the operatives. Carbonic acid up to 50 or even 100 parts per 10,000 in the air breathed is of no importance in itself. Caisson workers and divers constantly work in higher proportions than this. I have myself been exposed many times and for hours at a time to partial pressures of carbonic acid exceeding 100 parts per 10,000, and without the slightest discomfort or any after effect. Men equipped in the Fleuss Siebe-Gorman breathing apparatus have performed under my observation the heaviest labour up to 340,000 ft. lbs. in two hours with 20 to 120 parts per 10,000 of carbonic acid in the breathing bag.

The ill effects of crowded rooms are due to the heat and humidity, and nervous fatigue from excessive illumination and excitement, not to the increase of carbonic acid. I think it is very doubtful whether the unpleasant smelling exhalations of the bodies of men, which become evident in close atmospheres, have any ill effect on men accustomed to them and not of æsthetic temperament; the bulk of the population prefer warm shut-up rooms. The stimulating and healthful effect of fresh moving air on metabolism is undoubted, but in the weaving sheds we are faced with the necessity of enduring a shut-up humid atmosphere, and it seems best to obtain it by the method which is most comfortable to the operatives. If they prefer a lessened ventilation and no artificial steaming of the air, I would let them have it, so long as the wet bulb was kept within the limits defined by Dr. Haldane.

As to the question of infection in such less well-ventilated atmospheres, I would point out that the experiments of Buchner, Flugge, and others have shown that tubercle bacilli and other organisms are sprayed through a room from the mouth, when men talk or cough, for a distance of many feet, and over wide areas, and that susceptible animals, such as guinea-pigs, are infected when extraordinarily small doses of tubercle bacilli are sprayed into the room in which they are placed. In the case of influenza, the conditions of civilised life in railway and tram cars, meeting houses, and living rooms render all infected, who are not immune.

Modern investigation points to the enormous importance of an immune stock, and to the effect of cheap, good food and comfortable conditions of life in preventing tuberculosis. We are all constantly exposed to infection, but our resistance prevents it. I do not think, therefore, that the lessened ventilation will have any effect in increasing disease, so long as it does not increase the amount of trade dust in the air.

* Rübner and Lewaschew, Arch. für. Hygiene, 29.1.1897.

† A man at work lost by evaporation three or four times this amount of water.

‡ Arch. für. Physiol. 1879, Suppl. 72.

§ Luftdruck-Erkrankungen, Wien, 1900.

APPENDIX VII.

CARDWELL MILL, BLACKBURN.

COMPARISON OF NEW SHED WITH OLD SHED divided into four periods viz.--

- No. 1 period, viz.—When both sheds are non-ventilated and non-humidified.
 No. 2 „ —When one shed is ventilated and non-humidified and the other untouched.
 No. 3 „ —When one shed is ventilated and humidified by steam jets, and the other untouched.
 No. 4 „ —When one shed is ventilated and humidified by “Vortex” system in summer time and the other untouched.
 No. 4A „ —When one shed is ventilated and humidified by “Vortex” system in winter time and the other untouched.

PERIOD No. 1—From May 13th, 1905 to October 6th, 1906.

<i>Old Shed.</i>					<i>New Shed.</i>				
Non-ventilated and non-humidified.					Non-ventilated and non-humidified.				
	Morning.		Afternoon.			Morning.		Afternoon.	
Average.	Dry.	Wet.	Dry.	Wet.	Average.	Dry.	Wet.	Dry.	Wet.
Temperatures - -	74.1	68.7	76.1	70.1	Temperatures - -	71.0	67.2	73.5	68.8
Earnings off 2 looms	12/11.35				Earnings off 2 looms	12/9.54			
Sickness percentage daily - - -	.054 per cent.				Sickness percentage daily - - -	.032 per cent.			
Breakages on beams per piece of 40 yds.	.59 per cent. of ends.				Breakages on beams per piece of 40 yds.	.74 per cent. of ends.			

PERIOD No. 2—From October 6th to March 27th, 1907.

Old Shed					New Shed.				
Non-ventilated and non-humidified.					Ventilated with "Blackmann Fans."				
	Morning.		Afternoon.			Morning.		Afternoon.	
Average.	Dry.	Wet.	Dry.	Wet.	Average.	Dry.	Wet.	Dry.	Wet.
Temperatures - -	69.3	65.2	71.0	66.5	Temperatures . -	67.9	62.6	69.3	63.4
Earnings off 2 looms	13/3.71				Earnings off 2 looms	13/1.29			
Sickness percentage daily - - -	.080 per cent.				Sickness, percentage daily - - -	.077 per cent.			
Breakages on beams, per piece of 40 yds.	.59 per cent. of ends.				Breakages on beams, per piece of 40 yds.	.68 per cent. of ends.			

PERIOD No. 3—From March 27th, 1907, to June 12th, 1907.

<i>Old shed.</i>					<i>New Shed.</i>				
Non-ventilated and non-humidified.					Ventilated and humidified with "Steam Jets."				
	Morning.		Afternoon.			Morning.		Afternoon.	
Average.	Dry.	Wet.	Dry.	Wet.	Average.	Dry.	Wet.	Dry.	Wet.
Temperatures -	71.9	67.0	74.5	69.4	Temperatures -	69.1	64.9	71.2	66.8
Earnings off 2 looms	13/3.19				Earnings off 2 looms	13/4.60			
Sickness percentage daily - - -	.0802 per cent.				Sickness percentage daily - - -	.0432 per cent.			
Breakages on beams per piece of 40 yds.	.62 per cent. of ends.				Breakages on beams per piece of 40 yds.	.62 per cent. of ends.			

PERIOD No. 4—From June 12th, 1907, to September 30th, 1907.

Old Shed.					New Shed.				
Non-ventilated and non-humidified—Summer-time.					Ventilated and humidified with " Vortex " system—Summer-time.				
	Morning.		Afternoon.			Morning.		Afternoon.	
Average.	Dry.	Wet.	Dry.	Wet.	Average.	Dry.	Wet.	Dry.	Wet.
Temperatures - -	75.6	70.7	78.4	72.9	Temperatures - -	68.8	64.5	70.4	66.3
Earnings off 2 looms	13/2.06				Earnings of 2 looms	13/2.29			
Sickness per centage daily - - -	.0514 per cent.				Sickness per centage daily - - -	.090 per cent.			
Breakages on beams per piece of 40 yds.	.63 per cent. of ends.				Breakages on beams per piece of 40 yds.	.63 per cent. of ends.			

PERIOD No. 4A.—From September 30th to December 12th, 1907.

Same conditions as in Period No. 4, only Winter time.

Old Shed.					New Shed.				
Morning.					Afternoon.				
Average.	Dry.	Wet.	Dry.	Wet.	Average.	Dry.	Wet.	Dry.	Wet.
Temperatures - -	71.4	67.2	72.6	67.7	Temperatures - -	67.9	63.9	68.8	63.9
Earnings off 2 looms	13/4.16				Earnings off 2 looms	13/3.85			
Sickness per cent. daily - - -	.091 per cent.				Sickness per cent. daily - - -	.091 per cent.			
Breakages on beams per piece of 40 yds.	.56 per cent. of ends.				Breakages on beams per piece of 40 yds.	.47 per cent. of ends.			

APPENDIX VIII.

DRAFT NOTES ON EVIDENCE FOR THE HOME OFFICE HUMIDITY COMMITTEE by JOHN CADMAN, D.Sc., Professor of Mining at Birmingham University, late H.M. Inspector of Mines.

1. For a number of years I have been studying the effect of temperature upon workmen employed in mines, and in the tropics. I have come to the conclusion that the individual susceptibility to temperature depends entirely upon the temperature recorded by the wet bulb thermometer, no matter what the dry bulb registers.

2. I attach table showing some records with notes referring to the amount of clothing worn by workers under these conditions, together with special observations upon my own feelings under such conditions. I also include photographs illustrating some of these cases.

3. The general conclusions may be briefly stated as follows:—

72° *Wet bulb*.—Inconvenience is experienced, unless heavy clothing is removed and light clothing worn.

78° *Wet bulb*.—Little inconvenience is felt if considerable bare-body surface is exposed. Hard work is much facilitated if a perceptible current is passing over the body.

82° *Wet bulb*.—If clothes be removed, and maximum body surface exposed, work can be done providing current of air is available.

85° *Wet bulb*.—Body temperature becomes affected, and only light work is possible

95° *Wet bulb*.—Work becomes impossible.

(Signed) JOHN CADMAN.

TABLE ILLUSTRATING DR. CADMAN'S EVIDENCE IN UNDERGROUND WORKINGS OF MINES.

No.	Temperature, degrees F.		Remarks.
	Dry bulb.	Wet bulb.	
1	72	59	Quite comfortable and no inclination to remove clothing.
2	67	65.5	Men working with clothes on, coats removed. Perspired freely on excessive exertion.
3	83	66	Men working with shirts and vests on, only coats removed. Felt quite comfortable on walking slowly, no inclination to remove clothing.
4	72	67	Quite comfortable at this temperature, but inclination to remove some clothing on exertion.
5	72	69	Men working with light clothing on, see photograph No. 1. No perceptible air current here, men working in cramped positions. I did not feel inclination to remove clothing until commenced to excessively exert myself in crawling along narrow roadway.
6	74	69	Men working without shirts away from air current. Did not feel excessively hot myself.
7	72	70	At this temperature men are working without shirts, see photographs 2 and 3. Work is laborious. I did not feel any great desire to remove clothing.
8	73.5	72	Perspired freely on walking, had to remove coat and scarf. Men working in undervest.
9	79	72.5	Men working naked to the waist. On removing coat I felt comfortable.
10	75	72	Perspired freely on walking; removed coat and vest. When sitting in current of air felt exceedingly comfortable. Men working naked to waist, no perceptible current of air.
11	83	73	Men working with small knickers and light vests similar to photograph 1.
12	95.5	74	Men working devoid of clothing, but said the working place was cool compared with other parts of the mine, where wet bulb temperature rose to 78° and 80°, with same dry bulb temperature. On removing coat and vest and wearing light pants I did not experience any great inconvenience.
13	76	74	Men working naked to the waist. I perspired freely on exertion, removed coat and vest.
14	76.5	75	Perspired freely on slowly walking, no inclination to excessively exert myself. Men working stripped to the waist, with bathing drawers on.
15	77	75	Men working without shirts, bare skin.
16	77	75	On removing coat and vest felt depressed, became relieved on removing shirt. Men working without shirts, bare skin.
17	80	77	Men working in bathing drawers and stockings, bare upper part of bodies. Felt depressed on exertion.
18	78	78	Perspired very freely on slight exertion. Compelled to remove clothing. Men working naked to the waist; see photograph 4.
19	95.5	78	With only light clothing on, overall pants and vest, felt quite comfortable. Men working naked.
20	96	78	Men working devoid of clothing, only wearing boots. I was wearing overall pants and felt little inconvenience so long as I was in a current of air. On walking rapidly up an incline 1 in 3½ for about 150 yards I perspired very freely, and my body temperature (in mouth) rose to 100.1°.
21	96.5	78	Same clothing as in 20. After crawling along a low road on hands and knees for 100 yards I felt very depressed. My temperature went up to 101.6°. The manager, who was with me, and accustomed to travelling about under these conditions, showed a mouth temperature of 99.6°.
21	81	79	Men working in bathing drawers, otherwise naked. Felt very depressed myself and perspired freely. Perspiration did not appear to leave surface of body to any extent. Felt much more comfortable on getting into a breeze at same temperature.
22	96	79	Men working naked. At rest in a breeze I felt no discomfort, but on exertion felt distinct depression.
23	98	80	Men working naked. I was stripped to the waist; had no inclination to exert myself.
24	82	81	Men working in bathing drawers and perspired freely. On exertion, consisting of walking up an incline 1 in 4 for 60 yards, my mouth temperature rose to 100°.
25	96.5	82	Men working naked and perspiring very freely. I perspired very freely and experienced slight headache, no desire to exert myself; body temperature rose to 100.3° with very slight exertion. The work in the place was very light compared with average work in mines. The men were loading three tons of coal per day under these conditions

No.	Temperature, degrees F.		Remarks.
	Dry bulb.	Wet bulb.	
26	111	82	Large current of air passing here; men were working naked, pushing waggons about. Did not feel any great inconvenience, perspired freely, and moisture evaporated from body very quickly. Quite comfortable at rest; eyes felt a little burning sensation. Rails and waggons felt hot to the touch.
27	86	86	Only wearing vest and light pants, perspired very freely; unable to exert myself very much. Men did not appear to be doing much work.
28	87	87	Felt very depressed; men unable to work in this temperature. Remained at rest for 30 minutes. My mouth temperature rose to 99·9° and was still rising when I came out. The under-manager, accustomed to the pit, showed temperature of 100°.
29	93	93	Excessively uncomfortable, my mouth temperature rose to 102·5°. Had no desire to move about. Dr. Boycott, who accompanied me, experienced a temperature of 103·5°, and for some time lay full length on the floor in a state of collapse. Men employed in this place did not appear to be doing any work. The men are reported to wet the drill holes by pouring the sweat out of their boots.

TEMPERATURES OBSERVED IN TRINIDAD.

30	83	73	Working in office at rest, no discomfort.
31	84	76	Sitting in shade after walking in sun with temperature 112° dry bulb, perspired freely but felt no discomfort.
32	86	78	Natives working excavating asphalt at this temperature. Very little work was being done, but little inconvenience appeared to be experienced. The temperature at this work occasionally rose to 120° dry, 80° wet. Little difference in effect upon the workers was noted. See figure 5.
33	85	80	Very depressed, no inclination to exert myself. Everyone seemed very disinclined to work.
34	85	81	No breeze, very uncomfortable; unable to concentrate thoughts on any subject.
35	87	83	Very depressed, unable to exert myself to any degree. On turning on electric fan and sitting in breeze felt very refreshed and able to do a little writing.

These observations are taken from my notebook containing a considerable number of observations. In all the cases noted my body temperature was normal. At the time these notes were recorded I had been in the colony of Trinidad two years, and was fully acclimatised.

APPENDIX IX.

PRÉCIS OF EVIDENCE BY DR. ARTHUR RANSOME, F.R.S.

It is generally recognised that a warm, damp atmosphere is not conducive to health. It tends to prevent exhalation from the skin and lungs and promotes the deposit of impure water on surrounding surfaces.

The condensed aqueous vapour is, indeed, highly charged with organic matter. As I have shown ("Researches on Tuberculosis," p. 23) the vapour from healthy breath contains 3·568 parts per 100,000 of albuminoid ammonia, nearly as much as the Thames sewage at the south outfall. In the same research I have also shown that it is an excellent medium for the cultivation of micro-organisms, both putrefactive and pathogenic.

But the problem of the influence of heat and aqueous vapour upon health is not a simple one. It is associated with questions of the relative degree of moisture, and with the amount of ventilation.

The human body has considerable powers of adaptation to surrounding conditions, and, if condensation of vapour is prevented by a certain degree of dryness of the air and by ventilation, it is not certain that the presence of even a considerable amount of gaseous

water in the atmosphere is prejudicial to health, especially if the air is free from pathogenic germs.

It seems to me that the only methods of studying this complex problem are (1) actual personal experience and observation, (2) by records of sickness and invaliding in humidified and non-humidified sheds, and (3) by similar statistics of mortality from various diseases.

All these methods were brought into use by the Committee of which I was a member, and though most of the data were admittedly somewhat inadequate, we came to the conclusion that in most of the humidified sheds the health of the operatives was above the average, and that in the workplaces from which complaint came, the undoubted bodily discomfort and even ill-health that had arisen was due, not so much to the degree of moisture or the heat as to the imperfect ventilation and the impure sources of water used for purposes of humidifying.

There were also some cases of ill-health that seemed to have arisen from the wearing of damp clothing, and the suggestion was made that in all mills warm cloakrooms should be provided.

APPENDIX XI.

SUMMARY OF AIR SAMPLES TAKEN IN DRY WEAVING SHEDS FROM 1st JANUARY, 1906, TO 30th APRIL, 1907.

District.	Sheds in district.	January to April, 1906.														May to August, 1906.							September to December, 1906.							January to April, 1907.							Totals.													
		<6	<9	<12	<15	<20	<25	Over 30	Total.	<6	<9	<12	<15	<20	<25	Over 30	Total.	<6	<9	<12	<15	<20	<25	Over 30	Total.	<6	<9	<12	<15	<20	<25	Over 30	Total.	<6	<9	<12	<15	<20	<25	Over 30	Total.									
Lancashire (North)	492	3	9	5	6	12	8	6	4	53	45	47	26	6	7	—	—	—	1	3	9	4	4	8	3	6	38	5	40	49	16	22	6	2	4	144	54	99	89	32	45	22	11	14	366					
Lancashire (South)	623	5	7	13	5	8	5	4	3	50	28	39	15	7	4	—	—	—	25	54	23	15	12	4	—	6	139	3	24	43	19	21	6	2	—	118	61	124	94	46	45	15	6	9	400					
Cheshire	52	—	1	3	2	1	2	1	—	10	5	7	1	1	—	—	—	—	3	4	6	4	3	1	1	—	22	—	3	—	—	—	—	—	—	3	8	15	10	7	4	3	2	—	49					
Derbyshire	121	21	24	17	8	3	1	—	—	74	—	1	—	—	—	—	—	—	1	10	5	3	4	—	—	—	22	5	10	11	2	—	1	—	—	29	36	40	31	14	3	2	—	—	126					
Yorkshire	165	4	13	20	11	8	8	1	—	65	10	16	2	1	—	—	—	—	1	15	4	1	—	—	—	—	21	2	3	1	1	—	—	—	7	17	47	27	14	8	8	1	—	122						
Warwickshire	62	31	22	3	1	2	1	1	—	61	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	31	22	3	1	2	1	1	—	61						
Staffordshire	48	10	25	4	2	—	—	—	—	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	25	4	2	—	—	—	—	41						
Leicestershire	6	3	2	1	—	—	—	—	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	2	1	—	—	—	—	—	6						
Nottinghamshire	1	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1					
London	6	—	—	—	—	—	—	—	—	—	4	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	1	—	1	—	—	—	—	6					
Other parts	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Scotland	58	1	6	4	4	5	4	3	3	30	15	9	1	1	—	—	—	—	2	1	2	5	1	1	—	12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
United Kingdom	1636	78	110	70	39	39	29	16	10	391	107	120	45	17	11	—	—	—	42	82	47	33	20	14	4	12	254	15	80	104	38	43	13	4	4	301	242	392	266	127	113	56	24	26	1246					
Per cent.	—	19.9	28.2	17.9	9.9	9.9	7.4	4.1	2.6	100	35.7	40.0	15.0	5.7	3.7	—	—	—	16.5	32.3	18.5	13.0	7.9	5.5	1.6	4.7	100	5.0	26.6	34.6	12.6	14.8	4.3	1.3	1.3	100	19.4	31.4	21.4	10.2	9.1	4.5	1.9	2.1	100					

<6=below 6 volumes CO₂ per 10,000.
<6—to 9
etc.

NOTE.—The figures relate to sheds in which samples have been taken; when two or more samples have been taken at the same time the figures refer to the average result.

APPENDIX XII.

COMPARISON BETWEEN AIR SAMPLES TAKEN BY DR. PICKARD AND THOSE TAKEN BY THE HOME OFFICE AUTHORITIES
in certain non-humid Weaving Sheds.

No. of shed.	Winter.								Summer.							
	Dr. Pickard.		Home Office.						Dr. Pickard.		Home Office.					
	1904.		1903.		1905.		1906 and 1907.		1908.		1903.		1905.		1906 and 1907.	
	Date.	Result.	Date.	Result.	Date.	Result.	Date.	Result.	Date.	Result.	Date.	Result.	Date.	Result.	Date.	Result.
1A	28-11-04	14.3	--	--	--	--	10-1-07	9.4	27-4; 4-5	8.6	--	--	1-4-05	15.5	18-4-06	9.2
1B									and 14-5-08	8.6	--	--	--	--	18-4-06	5.5
2	28-11-04	19.2	--	--	--	--	--	--	27-4; 14-5	10.1	--	--	--	--	--	--
3	29-11-04	21.8	--	--	--	--	29-12-06	20.6	27-4-08	9.6	--	--	--	--	--	--
4	29-11-04	18.4	--	--	--	--	--	--	27-4; 22-5	10.7	--	--	--	--	--	--
5A	7-12-04	22.4	10-11-03	9.0	--	--	--	--	27-4; 4-5	11.8	24-7-03	6.9	--	--	--	--
5B			10-11-03	7.1	--	--	--	--	and 14-5-08	11.2	--	--	--	--	--	--
6	7-12-04	19.5	10-11-03	11.5	--	--	24-11-06	15.0	29-4; 14-5	8.0	--	--	12-4-05	13.5	16-5-06	8.2
7	2-12-04	20.8	--	--	--	--	16-1-07	22.2	29-4-08	12.0	--	--	--	--	--	--
8	5-12-04	10.3	11-11-03	20.9	--	--	--	--	29-4-08	6.2	24-7-03	7.8	--	--	15-6-06	7.5
9	2-12-04	14.6	--	--	--	--	21-2-06	15.1	29-4-08	7.6	24-7-03	8.1	--	--	--	--
10	2-12-04	16.4	--	--	--	--	--	--	29-4-08	10.7	--	--	--	--	--	--
11	29-11-04	19.7	--	--	--	--	--	--	29-4-08	8.6	--	--	--	--	--	--
12	29-11-04	28.1	--	--	--	--	21-12-06	23.9	29-4-08	18.2	--	--	--	--	--	--
13	1-12-04	10.6	--	--	--	--	11-1-07	11.8	29-4; 22-5	9.9	--	--	--	--	--	--
14	1-12-04	17.1	--	--	--	--	--	--	29-4; 22-5	9.5	--	--	--	--	7-8-06	13.7
15	1-12-04	10.4	--	--	--	--	--	--	29-4-08	11.9	--	--	--	--	--	--
16	--	--	--	--	--	--	--	--	4-5-08	6.3	--	--	--	--	11-6-06	6.0
17	--	--	--	--	--	--	--	--	4-5-08	12.8	--	--	--	--	12-6-06	6.5
18	--	--	--	--	--	--	29-12-06	35.8	4-5; 22-5	15.4	--	--	--	--	12-6-06	6.0
19	--	--	--	--	--	--	--	--	4-5; 14-5	12.0	--	--	--	--	--	--
20	--	--	--	--	--	--	19-2-07	10.0	4-5; 14-5	8.9	--	--	--	--	--	--
21	--	--	--	--	--	--	--	--	4-5; 14-5	10.5	--	--	--	--	--	--
22A	--	--	--	--	--	--	--	--	4-5; 14-5	11.3	--	--	--	--	--	--
22B	--	--	--	--	--	--	--	--	4-5; 14-5	13.3	--	--	--	--	--	--
23	--	--	--	--	--	--	21-12-06	16.5	8-5-08	10.6	--	--	--	--	--	--
24	--	--	--	--	--	--	--	--	8-5-08	14.8	--	--	--	--	--	--
25	--	--	--	--	--	--	--	--	8-5-08	11.0	--	--	--	--	--	--
26	--	--	--	--	--	--	--	--	8-5-08	12.4	--	--	--	--	--	--
27	--	--	--	--	--	--	21-12-06	12.7	8-5-08	9.1	--	--	--	--	--	--
28	--	--	--	--	--	--	21-12-06	11.0	8-5-08	7.7	--	--	--	--	--	--
29	--	--	--	--	--	--	--	--	8-5-08	9.0	--	--	--	--	--	--
30	--	--	--	--	--	--	21-12-06	10.4	8-5-08	8.0	--	--	--	--	--	--
31	--	--	--	--	--	--	--	--	8-5-08	7.2	--	--	--	--	--	--
32	--	--	--	--	--	--	--	--	8-5-08	7.0	--	--	--	--	--	--
33	--	--	--	--	--	--	20-2-07	6.8	8-5-08	10.1	--	--	--	--	--	--
34	5-12-04	17.5	--	--	--	--	21-12-06	22.7	8-5-08	6.1	24-7-03	7.6	--	--	--	--
35	--	--	--	--	--	--	20-2-07	9.5	8-5-08	8.3	--	--	--	--	--	--
36	--	--	--	--	--	--	21-12-06	11.2	8-5-08	8.5	--	--	--	--	--	--
37	--	--	--	--	--	--	--	--	12-5; 20-5	5.5	--	--	--	--	11-6-06	6.2
38	--	--	--	--	--	--	--	--	12-5; 20-5	10.3	--	--	--	--	11-6-06	6.2
39	--	--	--	--	--	--	--	--	12-5; 20-5	13.3	--	--	--	--	11-6-06	7.5
40	--	--	--	--	--	--	--	--	12-5; 20-5	9.2	--	--	--	--	11-6-06	8.0
41	--	--	--	--	--	--	--	--	12-5; 20-5	7.1	--	--	--	--	11-6-06	8.5
42	1-12-04	13.9	--	--	--	--	2-2-07	14.5	12-5; 20-5	10.6	--	--	--	--	--	--
43	--	--	--	--	--	--	--	--	12-5; 20-5	13.0	--	--	--	--	--	--
44	--	--	--	--	--	--	--	--	12-5; 20-5	6.2	--	--	--	--	15-6-06	10.0
45	--	--	--	--	--	--	--	--	12-5; 20-5	7.5	--	--	--	--	--	--
46	--	--	--	--	--	--	--	--	12-5; 20-5	6.1	--	--	--	--	--	--
47	--	--	--	--	--	--	--	--	12-5; 20-5	7.9	--	--	--	--	15-6-06	8.7
48	--	--	--	--	--	--	--	--	12-5; 20-5	7.0	--	--	--	--	15-6-06	8.5
49	--	--	--	--	--	--	16-1-07	16.8	12-5; 20-5	5.7	--	--	--	--	--	--
50	--	--	--	--	--	--	19-2-07	11.0	12-5; 20-5	6.4	--	--	--	--	--	--
51	--	--	--	--	--	--	19-2-07	10.0	12-5; 20-5	7.3	--	--	--	--	--	--
52	--	--	--	--	--	--	--	--	14-5; 22-5	9.2	--	--	--	--	--	--
53	28-11-04	14.3	--	--	--	--	--	--	14-5; 22-5	9.7	--	--	--	--	--	--
54	--	--	--	--	--	--	--	--	14-5-08	9.6	--	--	--	--	--	--
55	--	--	--	--	--	--	19-2-07	9.0	14-5-08	7.9	--	--	--	--	--	--
56	--	--	--	--	--	--	19-2-07	6.9	14-5-08	8.1	--	--	--	--	--	--
57	--	--	--	--	--	--	29-11-06	23.3	14-5-08	12.9	--	--	12-4-05	9.5	--	--
58	--	--	--	--	--	--	29-11-06	15.0	14-5-08	9.5	--	--	--	--	16-5-06	8.2
59	--	--	--	--	--	--	--	--	22-5-08	10.9	--	--	--	--	--	--
60	--	--	--	--	--	--	--	--	22-5-08	9.9	--	--	--	--	16-5-06	5.7
61	--	--	--	--	--	--	--	--	22-5-08	6.7	--	--	--	--	16-5-06	5.5
62	--	--	--	--	--	--	--	--	22-5-08	15.8	--	--	--	--	--	--
63	--	--	--	--	--	--	--	--	22-5-08	15.6	--	--	--	--	--	--
64	--	--	10-11-03	12.5	--	--	--	--	22-5-08	7.5	--	--	--	--	--	--
65	2-12-04	11.6	--	--	--	--	21-2-06	19.3	--	--	27-7-03	8.6	--	--	--	--
66	5-12-04	7.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
67	7-12-04	30.5	--	--	--	--	29-12-06	36.0	--	--	27-7-03	5.0	--	--	--	--
Average		17.3	--	12.2	--	--	--	15.8	--	9.7	--	7.3	--	12.8	--	7.7

TABLE B.

Sizing—Medium (25 to 70 per cent.).

MEAN MONTHLY TEMPERATURES AND HUMIDITIES OF TEN HUMID SHEDS for 1906 compared with the outside temperatures and humidities at the same hours.

C = centre readings; S = side readings.

Month.	Between 7 and 8 a.m.										Between 10 and 11 a.m.										Between 3 and 4 p.m.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	Temperature.					Humidity.					Temperature.					Humidity.					Temperature.					Humidity.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	Dry bulb.		Wet bulb.		Relative (saturation = 100).	Absolute (grains per cubic foot).		Relative (saturation = 100).	Dry bulb.		Wet bulb.		Absolute (grains per cubic foot).	Relative (saturation = 100).	Dry bulb.		Wet bulb.		Absolute (grains per cubic foot).	Relative (saturation = 100).	Dry bulb.		Wet bulb.		Absolute (grains per cubic foot).	Relative (saturation = 100).																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	Inside	Outside	Difference.	Inside		Outside	Difference.		Inside	Outside	Difference.	Inside			Outside	Difference.	Inside	Outside			Difference.	Inside	Outside	Difference.			Inside	Outside	Difference.	Inside	Outside	Difference.	Inside	Outside	Difference.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

TABLE C.
MEAN MONTHLY TEMPERATURES AND HUMIDITIES OF TEN HUMID SITES for 1906 compared with the outside temperatures and humidities at the same hours.
C = centre readings; S = side readings.

Month.	Between 7 and 8 a. m.										Between 10 and 11 a. m.										Between 3 and 4 p. m.														
	Temperature.					Humidity.					Temperature.					Humidity.					Temperature.					Humidity.									
	Dry bulb		Wet bulb.		Difference.	Absolute (grains per cubic foot).		Relative (saturation = 100).		Ratio.	Dry bulb.		Wet bulb.		Difference.	Absolute (grains per cubic foot).		Relative (saturation = 100).		Ratio.	Dry bulb.		Wet bulb.		Difference.	Absolute (grains per cubic foot).		Relative (saturation = 100).		Ratio.					
	Inside	Outside	Inside	Outside		Inside	Outside	Inside	Outside		Inside	Outside	Inside	Outside		Inside	Outside	Inside	Outside		Inside	Outside	Inside	Outside		Inside	Outside	Inside	Outside		Inside	Outside	Inside	Outside	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
(1)																																			
January - { C. S.	62.5	38.9	23.6	58.2	37.7	20.5	4.7	2.4	2.3	76	90	.84	63.9	39.9	24.0	59.4	38.6	20.8	4.9	2.5	2.4	75	89	.84	65.3	40.9	24.4	60.7	39.0	21.7	5.1	2.5	2.6	75	85
February - { C. S.	60.0	33.9	26.1	55.8	32.7	23.1	4.3	2.0	2.3	75	87	.86	62.0	35.6	26.4	57.6	34.2	23.4	4.6	2.1	2.5	75	87	.86	61.6	39.1	25.5	59.9	36.4	23.5	5.0	2.2	2.8	74	79
March - { C. S.	60.5	—	26.6	56.4	—	23.7	4.5	—	2.5	76	—	.87	61.5	—	25.9	57.5	—	23.3	4.7	—	2.6	77	—	.88	63.7	—	24.6	59.5	—	23.1	5.0	—	2.8	77	—
April - { C. S.	59.7	36.9	22.8	55.8	35.1	20.7	4.4	2.1	2.3	77	84	.92	63.9	40.5	23.4	59.5	37.7	21.8	5.0	2.3	2.7	75	79	.95	67.2	43.1	24.1	62.4	39.3	23.1	5.4	2.3	3.1	74	72
May - { C. S.	59.5	—	22.6	55.6	—	20.5	4.4	—	2.3	76	—	.90	62.9	—	22.4	58.7	—	21.0	4.9	—	2.6	76	—	.96	65.4	—	22.3	61.0	—	21.7	5.2	—	2.9	76	—
June - { C. S.	60.4	39.7	20.7	56.5	36.7	19.8	4.5	2.2	2.3	77	77	1.00	67.1	47.0	20.1	62.4	42.1	20.3	5.4	2.5	2.9	75	68	1.10	72.0	51.2	20.8	66.3	44.0	22.3	6.0	2.5	3.5	70	57
July - { C. S.	60.6	—	20.9	56.5	—	19.8	4.5	—	2.3	76	—	.99	66.3	—	19.3	61.8	—	19.7	5.4	—	2.9	76	—	1.12	70.4	—	19.2	65.3	—	21.3	5.9	—	3.4	73	—
August - { C. S.	63.9	47.0	16.9	59.7	45.2	14.5	5.0	3.2	1.8	76	87	.87	69.7	50.5	19.2	64.6	47.3	17.3	5.8	3.3	2.5	73	79	.92	73.8	51.9	21.9	67.8	47.7	20.1	6.4	3.2	3.2	70	73
September - { C. S.	63.4	—	16.4	59.3	—	14.1	5.0	—	1.8	76	—	.87	68.1	—	17.6	63.5	—	16.2	5.6	—	2.3	75	—	.95	71.6	—	19.7	66.4	—	18.7	6.1	—	2.9	73	—
October - { C. S.	69.5	54.9	14.6	64.6	51.6	13.0	5.8	3.8	2.0	73	78	.94	75.3	60.2	15.1	69.3	54.8	14.5	6.7	4.0	2.7	70	69	1.01	79.9	61.3	18.6	72.9	55.8	17.1	7.4	4.2	3.2	67	70
November - { C. S.	68.7	—	13.8	63.9	—	12.3	5.6	—	1.8	74	—	.95	73.7	—	13.5	68.2	—	13.4	6.6	—	2.6	72	—	1.04	77.9	—	16.6	71.5	—	15.7	7.2	—	3.0	70	—
December - { C. S.	70.6	56.0	14.6	65.5	52.8	12.7	6.1	4.0	2.1	73	80	.91	76.4	61.3	15.1	70.2	56.0	14.2	6.8	4.2	2.6	70	70	1.00	80.5	63.9	16.6	73.5	57.6	16.5	7.5	4.2	3.3	67	63
Mean for 1906 - { C. S.	69.8	—	13.8	65.0	—	12.2	5.9	—	1.9	74	—	.92	74.7	—	13.4	69.2	—	13.2	6.7	—	2.5	72	—	1.03	78.3	—	14.4	72.1	—	15.1	7.3	—	3.1	70	—
	71.4	57.6	13.8	66.4	54.9	11.5	6.2	4.4	1.8	73	83	.88	76.8	62.7	14.1	70.8	58.1	12.7	7.0	4.6	2.4	71	74	.96	81.4	66.6	14.8	74.3	60.2	14.1	7.7	4.8	2.9	68	67
	70.7	—	13.1	65.9	—	11.0	6.1	—	1.7	75	—	.90	75.2	—	12.5	69.8	—	11.7	6.9	—	2.3	72	—	.97	79.3	—	12.7	73.1	—	12.9	7.6	—	2.8	70	—
	68.4	53.0	15.4	63.5	49.8	13.7	5.6	3.6	2.0	74	79	.94	73.9	60.1	13.8	68.3	55.0	13.3	6.6	4.1	2.5	72	71	1.01	78.5	60.2	18.3	72.0	54.8	17.2	7.2	4.0	3.2	69	69
	67.7	—	14.7	63.0	—	13.2	5.5	—	2.0	75	—	.95	72.3	—	12.2	67.2	—	12.2	6.3	—	2.2	74	—	1.04	76.4	—	16.2	70.6	—	15.8	7.0	—	3.0	72	—
	66.6	48.2	18.4	62.0	46.8	15.2	5.4	3.4	2.0	75	90	.83	70.1	51.6	18.5	65.1	48.9	16.2	5.9	3.5	2.4	73	82	.89	73.6	51.4	22.2	67.9	49.1	18.3	6.5	3.6	2.9	71	84
	65.9	—	17.9	61.7	—	14.9	5.4	—	2.0	77	—	.84	68.7	—	17.1	64.2	—	15.3	5.7	—	2.2	75	—	.89	71.5	—	20.1	66.7	—	17.5	6.3	—	2.7	74	—
	66.1	44.0	22.1	61.4	42.4	19.0	5.2	2.9	2.3	74	87	.85	67.2	44.8	22.4	62.3	42.9	19.4	5.4	2.9	2.5	73	85	.86	69.4	47.0	22.4	64.2	44.6	19.6	5.7	3.1	2.6	72	83
	66.2	—	22.2	61.6	—	19.2	5.3	—	2.4	75	—	.86	66.4	—	21.6	61.9	—	19.0	5.4	—	2.5	75	—	.88	68.0	—	21.0	63.3	—	18.7	5.6	—	2.5	74	—
	62.4	36.7	25.7	58.0	35.0	23.0	4.7	2.1	2.6	75	85	.88	64.1	37.1	27.0	59.5	35.2	24.3	4.9	2.1	2.8	72	84	.87	65.7	39.3	26.4	60.9	37.1	23.8	5.1	2.3	2.8	74	83
	62.8	—	26.1	58.5	—	23.5	4.8	—	2.7	76	—	.89	63.4	—	26.3	59.2	—	24.0	4.9	—	2.8	76	—	.90	64.6	—	25.3	60.3	—	23.2	5.1	—	2.8	76	—
Mean for 1906 - { C. S.	65.1	45.6	19.5	60.6	43.4	17.2	5.1	2.9	2.2	76	84	.91	69.2	49.3	19.9	64.1	45.9	18.2	5.7	3.1	2.6	73	77	.95	72.7	51.3	21.4	66.9	47.1	19.8	6.1	3.1	3.0	71	73
	64.9	—	19.3	60.4	—	17.0	5.0	—	2.1	76	—	.91	68.0	—	18.7	63.3	—	17.4	5.6	—	2.5	75	—	.97	70.9	—	19.6	65.8	—	18.7	6.1	—	3.0	73	—

APPENDIX XIV.

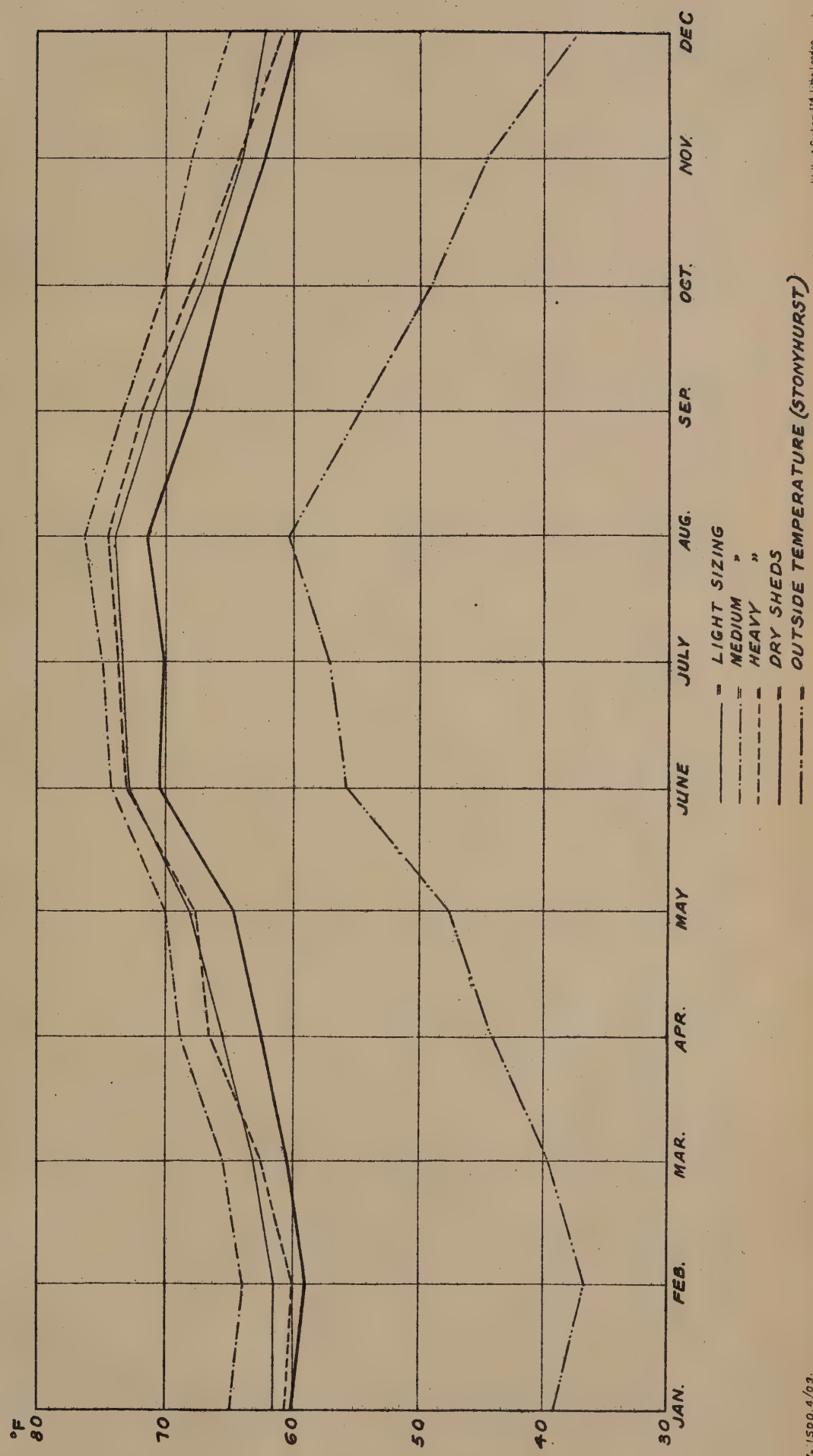
MEAN MONTHLY TEMPERATURES AND HUMIDITIES OF SIX DRY SHEDS FOR 1906 compared with the outside temperatures and humidities at the same hours.
C = centre readings.

Month.	Between 7 and 8 a.m.										Between 10 and 11 a.m.										Between 3 and 4 p.m.																	
	Temperature.					Humidity.					Temperature.					Humidity.					Temperature.					Humidity.												
	Dry bulb.		Wet bulb.		Relative (saturation = 100).	Absolute (grains per cubic foot).		Difference.			Dry bulb.		Wet bulb.		Relative (saturation = 100).	Absolute (grains per cubic foot).		Difference.			Dry bulb.		Wet bulb.		Relative (saturation = 100).	Absolute (grains per cubic foot).		Difference.										
	Inside.	Outside.	Inside.	Outside.		Inside.	Outside.	Inside.	Outside.		Inside.	Outside.	Inside.	Outside.		Inside.	Outside.	Inside.	Outside.		Inside.	Outside.	Inside.	Outside.		Inside.	Outside.	Inside.	Outside.	Inside.	Outside.	Ratio.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)		
January	-	C.	66.8	38.9	27.9	59.8	37.7	22.1	4.7	2.4	2.3	64	90	71	68.1	39.9	28.2	59.9	38.6	22.3	4.5	2.5	2.0	59	89	66	68.4	40.9	27.5	60.0	39.0	21.0	4.4	2.5	1.9	58	85	68
February	-	C.	65.4	33.9	31.5	58.4	32.7	25.7	4.4	2.0	2.4	63	87	72	66.7	35.6	31.1	58.1	34.2	23.9	4.1	2.1	2.0	58	87	67	67.4	39.1	28.3	58.9	36.4	22.5	4.3	2.2	2.1	58	79	73
March	-	C.	61.7	36.9	24.8	55.2	35.1	20.1	4.0	2.1	1.9	65	84	77	67.1	40.5	26.6	58.9	37.7	21.2	4.4	2.3	2.1	59	79	75	68.9	43.1	25.8	60.3	39.3	21.0	4.5	2.3	2.2	58	72	81
April	-	C.	59.5	39.7	19.8	52.3	36.7	15.6	3.5	2.2	1.3	60	77	86	67.7	47.0	20.7	58.6	42.1	16.5	4.2	2.5	1.7	56	68	82	72.5	51.2	21.3	62.5	44.0	18.5	4.8	2.5	2.3	54	57	95
May	-	C.	62.7	47.0	15.7	56.7	45.2	11.5	4.2	3.2	1.0	67	87	77	69.3	50.5	18.8	61.6	47.3	14.3	4.8	3.3	1.5	61	79	77	73.3	51.9	21.4	64.5	47.7	16.8	5.2	3.2	2.0	59	73	81
June	-	C.	68.5	54.9	13.6	61.2	51.6	9.6	4.8	3.8	1.0	63	78	81	74.9	60.2	14.7	66.2	54.8	11.4	5.6	4.0	1.6	59	69	86	79.8	61.3	18.5	70.2	55.8	14.4	6.3	4.2	2.1	57	70	81
July	-	C.	68.5	56.0	12.5	61.3	52.8	8.5	4.9	4.0	0.9	63	80	79	74.9	61.3	13.6	66.7	56.0	10.7	5.7	4.2	1.5	61	70	87	79.8	63.9	15.9	70.0	57.0	13.0	6.2	4.2	2.0	57	63	90
August	-	C.	69.0	57.6	11.4	62.4	54.9	7.5	5.1	4.4	0.7	65	83	78	75.7	62.7	13.0	67.5	58.1	9.4	5.9	4.6	1.3	62	74	84	81.3	66.6	14.7	71.7	60.2	11.5	6.7	4.8	1.9	58	67	86
September	-	C.	65.1	51.3	13.8	58.6	48.7	9.9	4.5	3.5	1.0	66	82	80	72.6	58.1	14.5	64.2	53.6	10.6	5.2	3.9	1.3	59	73	81	77.5	60.8	16.7	67.9	54.8	13.1	5.8	4.0	1.8	57	67	85
October	-	C.	64.8	47.8	17.0	58.9	46.7	12.2	4.6	3.5	1.1	68	92	74	69.9	50.5	19.4	62.6	48.2	14.4	5.1	3.5	1.6	64	84	76	73.3	51.7	21.6	65.6	49.2	16.4	5.6	3.8	1.8	63	83	76
November	-	C.	68.7	44.0	24.7	61.5	42.4	19.1	4.9	2.9	2.0	63	87	72	69.0	44.8	24.2	61.5	42.9	18.6	4.9	2.9	2.0	62	86	71	70.2	47.0	23.2	62.2	44.6	17.6	4.9	3.1	1.8	61	83	73
December	-	C.	65.4	36.7	28.4	58.1	35.0	23.1	4.3	2.1	2.2	62	85	73	67.7	37.1	30.6	59.2	35.2	24.0	4.3	2.1	2.2	58	84	69	68.1	39.3	28.8	59.6	37.1	22.5	4.4	2.3	2.1	58	83	70
Mean for 1906	-	C.	65.5	45.6	19.9	58.7	43.4	15.3	4.5	2.9	1.6	64	84	76	70.3	49.3	21.0	62.1	45.9	16.2	4.9	3.1	1.8	60	77	78	73.4	51.3	22.1	64.4	46.1	17.3	5.2	3.1	2.1	58	73	79

CHART I.

MEAN MONTHLY WET BULB TEMPERATURES AT 3 TO 4 P. M. IN CERTAIN SHEDS COMPARED WITH

THE MEAN MONTHLY OUTSIDE TEMPERATURE AT THE SAME HOUR FOR EVERY MONTH DURING 1906.



APPENDIX XVI.

MEAN TEMPERATURES, ETC., OF CERTAIN SHEDS for the month of June, 1908, arranged according to the methods of humidifying.

Number of shed.	Situation.	Humidifier.	Working days.	Between 7 and 8 a.m.				Between 10 and 11 a.m.				Between 3 and 4 p.m.			
				Temperature.		Humidity.		Temperature.		Humidity.		Temperature.		Humidity.	
				Dry bulb.	Wet bulb.	Absolute.	Relative.	Dry bulb.	Wet bulb.	Absolute.	Relative.	Dry bulb.	Wet bulb.	Absolute.	Relative.
Steam humidifiers.															
18	Todmorden	- Steam jets-	- 24	70.1	65.1	5.9	73	76.0	70.5	7.0	73	82.0	75.0	7.9	68
24a	Padiham-	- Steam jets-	- 24	67.1	61.5	5.1	71	72.5	66.5	6.0	69	79.5	72.6	7.3	68
29	Blackburn	- Steam jets-	- 19	73.3	66.9	6.1	69	79.0	71.1	6.8	63	82.0	73.5	7.3	62
30	Bacup	- Hart's	- 24	74.8	69.8	6.9	74	80.6	74.5	7.9	71	85.5	78.1	8.6	67
Mean	—	—	—	71.3	65.3	6.0	71	77.0	70.6	6.9	69	82.3	74.8	7.7	65
Steam and water humidifiers.															
8	Darwen	- Parson's	- 16	67.8	63.8	5.8	78	73.7	68.7	6.7	75	78.6	72.2	7.3	69
22	Rawtenstall	- Hall and Kay	- 20	69.5	63.2	5.3	67	76.0	68.9	6.4	67	81.2	73.2	7.2	64
24c	Padiham-	- Matthews and Yates	- 24	68.6	64.5	5.9	78	73.8	68.8	6.8	75	78.3	71.7	7.1	69
31	Burnley	- Pye's	- 20	69.3	64.3	5.8	73	74.9	69.1	6.7	71	79.4	72.6	7.4	68
Mean	—	—	—	68.0	63.5	5.4	72	74.6	68.9	6.7	71	79.4	72.4	7.2	67
Water humidifiers.															
17a	Todmorden	- Vortex	- 23	67.3	62.1	5.3	72	72.2	66.0	5.9	68	77.0	70.0	6.7	67
24b	Padiham	- Hygrofor	- 24	67.9	63.2	5.6	75	73.0	68.2	6.7	75	78.7	71.8	7.1	68
25	Blackburn	- Vortex	- 23	64.4	60.3	5.2	77	70.0	65.0	5.9	73	74.2	67.5	6.2	67
26	Chorley	- Vortex	- 20	62.7	59.7	5.2	83	67.0	63.2	5.7	79	69.8	65.1	6.0	74
27	Manchester	- Drosophore	- 17	70.0	67.0	6.7	83	75.3	70.8	7.2	77	78.5	73.4	7.8	75
28a	Blackburn	- Vortex	- 23	70.4	66.2	6.3	77	71.9	67.4	6.5	76	73.7	69.0	6.9	76
Mean	—	—	—	67.1	63.1	5.6	78	71.6	66.8	6.2	75	75.7	69.5	6.6	69
Dry shed.															
28b	Blackburn	-	23	73.9	69.5	7.0	77	77.2	72.6	7.7	77	79.9	74.7	8.2	74
	Outside (Stonyhurst)	-	26	55.1	51.6	3.8	78	60.0	55.1	4.1	71	63.6	56.9	4.2	64
	Outside (Darwen)	-	26	54.8	51.9	3.9	81	60.5	55.1	4.1	71	63.7	55.4	3.8	59

APPENDIX XVII.

Explanatory note.

The sheds in which these observations were taken are contiguous and situated under the same roof.

The dimensions, etc., of each shed are contained in the following table—

	Large shed.	Small shed.
Cubic Capacity (cubic feet)	453,096	68,073
Number of Looms - -	835	109
Number of Operatives -	246	40
Fans:—		
Number - - -	16	2
Diameter (inches) -	14	14
Speed (revolutions per minute) - - -	560	560
Delivery of air (cubic feet per hour) - - -	624,000	78,000

In the small shed only, the fan inlets are furnished with "saturators," consisting of cylindrical hoods covered with jute matting kept constantly moist; each saturator has a superficial area of 17'8 square feet.

In Table A, column 12 shows the difference between the true shade temperature and the temperature of the air introduced through the "dry" fan duct from the roof of the shed.

Column 13 gives the difference between the dry and wet bulb shade temperatures, which is the measure of the available cooling effect by water evaporation.

Column 14 gives the difference between the dry bulb temperatures of the fan inlets with and without a saturator respectively, and shows the actual cooling effect of the saturator.

OBSERVATIONS TAKEN FROM 16TH JULY TO 31ST AUGUST, 1908, AT ALBERT MILLS, NELSON.

TABLE A.

6 A.M.														8 A.M.													
Date.	Outside in shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between			Outside shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between			
	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	4 and 2.	2 and 3.	4 and 6.	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	4 and 2.	2 and 3.	4 and 6.	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	
July 16 -	60	56	59	57	58	57	66	—	63	—	1	4	1	58	56	61	58	59	57	70	—	—	—	3	2	2	
" 17 -	57	55	58	56	56	55	66	—	62	—	1	2	2	57	55	59	57	58	57	70	—	—	—	2	2	1	
" 18 -	57	53	58	54	55	52	66	—	63	—	1	4	3	56	53	62	57	59	56	70	—	67	—	6	3	3	
" 19 -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 20 -	59	56	59	56	57	50	66	—	64	—	0	3	2	60	56	62	57	60	58	71	—	68	—	2	4	2	
" 21 -	57	54	62	57	55	54	68	—	66	—	5	3	7	61	55	67	58	59	57	73	—	69	—	6	6	8	
" 22 -	57	53	57	55	54	52	68	—	64	—	0	4	3	63	56	64	57	61	58	72	—	69	—	1	7	3	
" 23 -	59	57	60	57	58	53	70	—	67	—	1	2	2	60	58	63	60	61	59	72	—	70	—	3	2	2	
" 24 -	65	61	60	57	59	56	69	—	67	—	5	4	1	63	59	67	61	62	60	73	—	70	—	4	4	5	
" 25 -	63	59	65	60	62	59	72	—	69	—	2	4	3	63	59	64	63	63	61	75	—	71	—	1	4	1	
" 26 -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 27 -	58	54	57	53	55	54	64	—	62	—	1	4	2	59	56	62	56	59	56	68	—	66	—	3	3	3	
" 28 -	63	59	60	55	55	54	68	—	64	—	3	4	5	60	57	63	58	60	58	71	—	69	—	3	3	3	
" 29 -	53	50	52	49	51	50	65	—	62	—	1	3	1	58	53	59	54	59	55	69	—	66	—	1	5	0	
" 30 -	62	55	60	55	57	55	68	—	66	—	2	7	3	62	57	65	59	61	59	72	—	70	—	3	5	4	
" 31 -	59	53	59	53	55	54	68	—	66	—	0	6	4	58	51	60	54	56	53	74	—	69	—	2	7	4	
Aug. 1 -	56	50	56	50	53	50	67	59	64	—	0	6	3	57	51	60	53	57	54	70	66	66	—	3	6	3	
" 2 -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 3 -	59	56	57	54	56	55	67	60	65	—	2	3	1	60	56	62	59	59	59	71	64	68	—	2	4	3	
" 4 -	62	60	65	61	60	59	72	65	68	—	3	2	5	63	61	65	62	62	61	76	67	72	—	2	2	3	
" 5 -	55	51	57	53	55	53	67	60	64	—	2	4	2	56	51	59	54	56	55	72	62	68	—	3	5	3	
" 6 -	56	53	58	54	56	55	67	59	64	58	2	3	2	58	53	62	56	59	55	71	63	67	61	4	5	3	
" 7 -	56	55	57	54	56	55	67	60	65	59	1	1	1	59	56	60	58	58	57	72	67	68	62	1	3	2	
" 8 -	56	54	57	54	56	54	69	61	67	60	1	2	1	60	56	62	57	59	59	75	66	70	63	2	4	3	
" 9 -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 10 -	62	58	63	59	55	53	67	62	65	60	1	4	8	62	58	65	60	59	54	71	65	68	64	3	4	6	
" 11 -	52	47	54	49	53	51	63	55	61	55	2	5	1	51	47	54	49	52	50	67	60	64	57	3	4	2	
" 12 -	46	43	43	41	46	45	60	52	57	50	2	3	2	50	46	53	49	53	51	66	57	61	55	3	4	0	
" 13 -	55	52	57	—	55	53	65	58	62	56	2	3	2	56	52	58	—	55	54	70	62	65	60	2	4	3	
" 14 -	55	50	53	—	53	52	66	59	62	57	2	5	0	56	53	56	—	55	55	71	64	65	60	0	3	1	
" 15 -	56	53	56	52	55	54	66	59	63	57	0	3	1	58	54	67	60	58	57	72	63	66	61	9	4	9	
" 16 -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 17 -	53	49	52	49	50	49	61	54	60	54	1	4	2	56	51	56	51	50	49	68	59	64	57	0	5	6	
" 18 -	54	50	57	52	55	53	66	58	63	57	3	4	2	55	50	58	52	55	54	70	62	66	60	3	5	3	
" 19 -	55	51	56	52	55	53	67	59	63	57	1	4	1	55	50	58	53	56	55	72	63	67	61	3	5	2	
" 20 -	54	50	56	51	55	53	66	59	63	57	2	4	1	55	51	60	54	56	54	71	62	66	60	3	4	4	
" 21 -	55	53	57	53	55	54	65	59	62	57	2	2	2	55	53	58	55	56	55	69	62	65	59	3	2	2	
" 22 -	56	55	58	55	56	55	66	60	63	58	2	1	2	57	56	60	57	58	57	71	64	66	62	3	1	2	
" 23 -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 24 -	54	53	56	53	55	54	61	57	60	55	2	1	1	55	54	57	55	56	55	66	60	64	60	2	1	1	
" 25 -	57	54	58	55	56	55	66	60	63	58	1	3	2	56	54	58	55	57	55	70	63	65	61	2	2	1	
" 26 -	57	54	57	55	56	55	67	60	62	58	0	3	1	56	54	58	55	57	56	70	63	66	61	2	2	1	
" 27 -	55	52	55	52	53	52	65	59	61	57	0	3	2	58	54	58	54	56	54	71	63	65	60	0	4	2	
" 28 -	56	53	55	53	53	52	65	59	61	57	1	3	2	55	53	56	53	55	53	69	62	64	60	1	2	1	
" 29 -	54	51	55	51	53	51	64	58	60	55	1	3	2	55	52	58	53	56	53	69	61	65	60	3	3	2	
" 30 -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 31 -	52	50	55	53	51	50	58	54	57	53	3	2	4	51	49	53	50	51	50	63	58	60	55	2	2	2	

TABLE A—continued.

OBSERVATIONS TAKEN FROM 16TH JULY TO 31ST AUGUST, 1908, AT ALBERT MILLS, NELSON.

Date.		10 A.M.												12 (NOON).													
		Outside in shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between			Outside in shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between		
												4 and 2.	2 and 3.	4 and 6.											4 and 2.	2 and 3.	4 and 6.
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
July 16	59	56	64	58	60	58	73 ¹ ₂	—	—	—	5	3	4	61	58	67	61	62	59	77	—	—	—	6	3	5	
" 17	60	57 ¹ ₂	62	59	60	58	74	—	—	—	2	2 ¹ ₂	2	66	60	99	60	63	59	79	—	—	—	3	6	6	
" 18	57	53	60	55	58	56	73	—	67	—	3	4	2	59	55	65	58	60	58	75	—	69	—	6	4	5	
" 19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 20	62	57	65	59	61	59	74	—	69	—	3	5	4	60	58	69	60	63	59	78	—	71	—	9	2	6	
" 21	64	58	66	59	62	59	78	—	72	—	2	6	4	67	60	74	64	66	61	82	—	75	—	7	7	8	
" 22	73	62	76	67	67	62	78	—	73	—	3	11	9	73	62	82	69	69	63	82	—	75	—	9	11	13	
" 23	67	61	68	61	63	59	76	—	72	—	1	6	5	69	60	70	62	64	60	78	—	74	—	1	9	6	
" 24	67	59	70	61	64	60	78	—	73	—	3	8	6	68	59	74	62	65	60	82	—	75	—	6	9	9	
" 25	63	61	66	63	64	62	78	—	73	—	3	2	2	64	61	74	68	70	68	78	—	79	—	10	3	4	
" 26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 27	64	57	67	58	62	58	72	—	70	—	3	7	5	65	58	70	60	64	59	77	—	72	—	5	7	6	
" 28	68	60	68	60	65	60	78	—	73	—	0	8	3	64	56	69	60	64	59	80	—	75	—	5	8	5	
" 29	65	58	65	57	58	54	77	—	70	—	0	7	7	68	59	75	63	67	61	82	—	75	—	7	9	8	
" 30	63	60	66	62	61	61	76	—	72	—	3	3	5	64	61	67	63	63	62	79	—	73	—	3	3	4	
" 31	58	52	63	55	59	56	75	—	70	—	5	6	4	63	56	65	57	56	51	77	—	73	—	2	7	9	
Aug. 1	62	54	63	55	55	52	75	64	70	—	1	8	8	62	55	67	63	56	52	79	68	73	—	5	7	11	
" 2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 3	60	60	69	62	63	61	72	67	72	—	9	0	6	69	63	76	66	66	64	81	75	75	—	7	6	10	
" 4	65	61	67	62	62	61	80	70	73	—	2	4	5	63	59	65	60	60	59	82	70	74	—	2	4	5	
" 5	57	51	62	55	55	53	76	66	70	63	5	6	7	59	52	66	57	58	55	80	72	71	64	7	7	8	
" 6	58	54	68	57	59	56	76	66	70	64	10	4	9	60	55	70	60	60	58	79	68	71	65	10	5	10	
" 7	65	60	67	62	64	62	79	69	71	66	2	5	3	68	62	77	66	65	62	82	72	75	69	9	6	12	
" 8	60	57	68	59	62	58	80	69	72	66	8	3	6	68	60	70	61	65	60	80	69	74	66	2	8	5	
" 9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 10	58	55	60	59	57	55	76	66	69	64	2	3	3	59	55	63	57	59	56	78	67	71	65	4	4	4	
" 11	56	51	58	53	55	54	72	63	66	60	2	5	3	57	51	60	55	56	54	75	65	68	61	3	6	4	
" 12	56	48	58	50	55	52	73	62	65	59	2	8	3	59	51	64	54	59	55	78	66	70	62	5	8	5	
" 13	57	46	61	—	57	56	74	64	67	61	4	11	4	58	54	61	—	58	57	76	66	70	64	3	4	3	
" 14	62	56	66	—	61	59	80	70	70	65	4	6	5	62	56	70	—	62	59	83	73	74	68	8	6	8	
" 15	61	55	67	59	60	58	77	67	70	64	6	6	7	63	54	77	66	61	61	77	67	71	64	14	9	16	
" 16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 17	62	54	63	55	60	57	74	64	66	60	1	8	3	64	56	71	60	63	60	77	67	69	62	7	8	8	
" 18	56	52	61	54	58	56	75	65	69	62	5	4	3	58	53	68	59	59	57	79	68	70	64	10	5	9	
" 19	58	52	62	53	58	55	77	67	69	62	6	6	6	59	52	64	55	59	56	80	69	70	64	5	7	5	
" 20	57	53	62	55	58	56	75	65	68	61	5	4	4	57	53	63	56	58	55	77	67	70	62	6	4	5	
" 21	55	53	58	55	57	56	72	64	66	61	3	2	1	56	54	59	56	58	57	75	67	69	62	3	2	1	
" 22	59	55	64	58	59	57	74	67	69	64	5	4	5	61	56	64	56	60	58	76	68	69	64	3	5	4	
" 23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 24	60	58	63	56	61	59	71	65	67	63	3	2	2	63	59	66	59	62	60	75	68	70	65	3	4	4	
" 25	59	55	60	56	59	56	73	65	67	62	1	4	1	60	57	63	58	59	57	76	68	69	63	3	3	4	
" 26	60	55	63	57	59	57	74	67	68	63	3	5	4	61	56	66	58	61	58	79	70	70	65	5	5	5	
" 27	60	56	60	54	60	56	75	66	67	62	0	4	0	62	57	64	55	61	57	79	68	70	64	2	5	3	
" 28	57	53	59	54	57	55	73	65	65	60	2	4	2	60	55	62	55	60	55	76	68	68	63	2	5	2	
" 29	58	53	60	54	59	55	73	65	66	61	2	5	1	59	53	65	53	61	56	74	66	68	62	6	6	4	
" 30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 31	56	51	59	52	55	53	67	61	62	57	3	5	4	57	52	61	54	57	54	73	65	65	60	4	5	4	

TABLE A—continued.

OBSERVATIONS TAKEN FROM 16TH JULY TO 31ST AUGUST, 1908, AT ALBERT MILLS, NELSON.

2 P.M.														4 P.M.													
Date.	Outside in shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between			Outside in shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between			
	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	4 and 2.	2 and 3.	4 and 6.	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	4 and 2.	2 and 3.	4 and 6.	
																											12
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12	13.	14.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	
July 16	58	55	63	58	59	57	76	—	73	—	5	5	4	59	57	64	60	61	59	77	—	74	—	5	2	3	
" 17	64	57	69	60	64	60	80	—	—	—	5	7	5	65	60	71	62	65	61	81	—	—	—	6	5	6	
" 18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 20	68	60	73	62	65	61	80	—	73	—	5	8	8	68	62	75	64	67	63	83	—	78	—	7	6	8	
" 21	69	61	76	64	67	62	84	—	77	—	7	8	9	69	60	79	65	68	62	86	—	81	—	10	9	11	
" 22	70	63	76	66	68	64	84	—	77	—	6	7	8	68	62	74	64	66	62	86	—	79	—	6	6	8	
" 23	69	61	70	63	67	62	81	—	75	—	1	8	3	67	60	73	64	66	61	84	—	79	—	6	7	7	
" 24	68	60	73	63	66	61	83	—	75	—	5	8	7	71	60	79	65	63	58	85	—	77	—	8	11	16	
" 25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 27	67	60	72	61	65	61	79	—	72	—	5	7	7	68	60	74	63	68	62	83	—	76	—	6	8	6	
" 28	66	58	72	60	65	60	82	—	75	—	6	8	7	65	58	71	61	65	60	84	—	78	—	6	7	6	
" 29	69	60	83	71	68	63	84	—	77	—	14	9	15	69	60	79	66	67	61	85	—	81	—	10	9	12	
" 30	66	62	69	64	64	62	80	—	74	—	3	4	5	66	62	69	64	64	62	82	—	75	—	3	4	5	
" 31	63	55	64	56	54	50	76	—	74	—	1	8	10	61	54	66	57	57	52	78	—	74	—	5	8	9	
Aug. 1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 3	72	65	78	68	68	61	83	72	77	—	6	7	10	70	64	74	66	67	64	85	73	79	—	4	6	7	
" 4	63	58	65	60	60	59	82	70	73	—	2	5	5	63	59	67	61	61	60	82	70	74	—	4	4	6	
" 5	59	53	65	57	59	56	79	68	71	64	6	6	6	60	54	69	60	60	57	82	70	72	65	9	6	9	
" 6	61	56	68	60	62	59	79	68	71	65	7	5	6	63	57	73	63	65	62	84	72	71	69	10	5	8	
" 7	67	61	75	65	66	63	83	72	77	60	8	6	9	67	62	75	67	68	64	85	74	80	72	8	5	7	
" 8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 10	58	55	62	57	59	57	78	67	70	65	4	3	3	60	55	63	57	58	55	79	68	73	66	3	5	5	
" 11	57	51	63	58	57	55	75	65	70	63	6	6	6	58	51	64	59	57	55	80	66	71	64	6	7	7	
" 12	59	51	64	55	59	55	78	66	70	62	5	8	5	57	51	61	54	57	54	79	66	70	62	4	6	4	
" 13	59	55	63	—	59	58	76	67	69	63	4	4	4	62	57	65	—	60	59	80	70	70	65	3	5	5	
" 14	63	58	75	64	65	61	84	72	75	69	12	5	10	62	56	80	68	62	59	86	73	75	69	18	6	18	
" 15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 17	65	57	74	63	65	61	80	70	78	66	9	8	9	64	57	72	61	64	61	82	71	75	66	8	7	8	
" 18	58	53	63	56	59	57	79	68	71	64	5	5	4	58	53	64	56	60	57	81	69	71	64	6	5	4	
" 19	60	54	65	59	60	57	80	68	70	64	5	6	5	60	54	65	57	60	57	84	71	72	64	5	6	5	
" 20	59	54	64	57	60	57	76	66	70	62	5	5	4	59	54	65	57	59	57	80	69	70	64	6	5	6	
" 21	58	55	63	58	60	58	75	67	79	63	5	3	3	59	56	68	61	61	59	79	69	71	65	9	3	7	
" 22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 24	63	56	66	57	62	59	77	69	70	65	3	7	4	64	58	68	58	63	59	80	71	72	66	4	6	5	
" 25	60	58	60	57	58	57	76	68	68	63	0	2	2	61	58	62	58	59	57	78	69	69	64	1	3	3	
" 26	61	59	64	60	63	61	78	69	70	65	3	2	1	63	60	67	62	63	61	80	72	71	67	4	3	4	
" 27	62	58	67	56	61	67	80	69	71	65	4	5	6	62	55	68	54	63	57	82	70	74	66	6	7	5	
" 28	61	54	66	56	63	57	78	68	70	64	5	7	3	56	53	64	55	57	54	79	69	70	64	8	3	7	
" 29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
" 31	57	50	60	54	56	54	73	64	65	60	3	7	4	55	51	60	55	65	53	74	65	64	59	5	4	5	

TABLE A—continued.

OBSERVATIONS TAKEN FROM 16TH JULY TO 31ST AUGUST, 1908, AT ALBERT MILLS, NELSON.

5.30 P.M.															5.30 P.M.														
Date.	Outside shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between			Date.	Outside shade.		In "dry" fan duct.		In "wet" fan duct.		In "large" shed.		In "small" shed.		Difference between				
	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	4 and 2.	2 and 3.	4 and 6.		DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	4 and 2.	2 and 3.	4 and 6.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.		
July 16	59	56	65	61	61	58	78	—	—	—	6	3	4	Aug. 9	—	—	—	—	—	—	—	—	—	—	—	—	—		
" 17	64	59	66	61	63	59	82	—	75	—	2	5	3	" 10	61	56	64	56	60	55	80	68	75	67	3	5	4		
" 18	—	—	—	—	—	—	—	—	—	—	—	—	—	" 11	57	50	63	59	57	54	80	67	72	64	6	7	6		
" 19	—	—	—	—	—	—	—	—	—	—	—	—	—	" 12	56	51	61	54	57	54	79	67	70	63	5	5	4		
" 20	69	62	76	64	68	63	84	—	—	—	7	7	8	" 13	61	57	68	—	63	60	81	71	74	67	7	4	5		
" 21	68	59	79	65	67	61	86	—	82	—	11	9	12	" 14	60	55	82	68	60	58	86	73	74	66	22	5	22		
" 22	66	60	81	71	65	63	87	—	78	—	15	6	16	" 15	—	—	—	—	—	—	—	—	—	—	—	—	—		
" 23	67	61	74	63	67	62	85	—	79	—	7	6	7	" 16	—	—	—	—	—	—	—	—	—	—	—	—	—		
" 24	70	61	80	68	68	63	88	—	78	—	10	9	12	" 17	64	57	72	61	64	60	84	72	75	66	8	7	8		
" 25	—	—	—	—	—	—	—	—	—	—	—	—	—	" 18	58	54	63	56	59	57	82	69	72	64	5	4	4		
" 26	—	—	—	—	—	—	—	—	—	—	—	—	—	" 19	60	54	65	57	60	57	83	72	72	64	5	6	5		
" 27	69	64	72	63	66	62	84	—	76	—	3	5	6	" 20	59	54	64	57	59	57	80	69	70	64	5	5	5		
" 28	64	57	69	60	64	59	85	—	78	—	5	7	5	" 21	—	—	66	59	61	59	80	70	71	65	—	—	5		
" 29	69	59	78	64	67	61	86	—	82	—	9	10	11	" 22	—	—	—	—	—	—	—	—	—	—	—	—	—		
" 30	66	63	71	65	63	65	84	—	77	—	5	3	8	" 23	—	—	—	—	—	—	—	—	—	—	—	—	—		
" 31	62	53	68	57	57	52	79	—	75	—	6	9	11	" 24	63	57	68	59	63	59	81	72	73	67	5	5	5		
Aug. 1	—	—	—	—	—	—	—	—	—	—	—	—	—	" 25	61	58	60	57	59	57	78	69	69	64	1	3	1		
" 2	—	—	—	—	—	—	—	—	—	—	—	—	—	" 26	63	60	67	62	63	61	80	72	71	67	4	3	4		
" 3	70	64	75	65	67	63	85	72	80	—	5	6	8	" 27	61	54	75	64	65	59	81	70	73	66	14	7	10		
" 4	62	59	71	66	61	60	82	70	75	—	9	3	10	" 28	58	52	60	53	57	54	80	69	70	64	2	6	3		
" 5	59	54	65	58	60	57	82	70	72	64	6	5	5	" 29	—	—	—	—	—	—	—	—	—	—	—	—	—		
" 6	60	58	75	65	66	61	85	74	77	70	15	2	9	" 30	—	—	—	—	—	—	—	—	—	—	—	—	—		
" 7	67	61	78	67	68	64	87	75	81	74	11	6	10	" 31	54	50	58	53	55	53	75	65	65	60	4	4	3		
" 8	—	—	—	—	—	—	—	—	—	—	—	—	—																

TABLE B.

SUMMARY OF OBSERVATIONS TAKEN FROM 16TH JULY TO 31ST AUGUST, 1908, AT ALBERT MILLS, NELSON.
Mean monthly wet and dry bulb temperatures in different positions.

Position.	Month.	Temperature.													
		6 a.m.		8 a.m.		10 a.m.		12 noon.		2 p.m.		4 p.m.		5.30 p.m.	
		D.B.	W.B.	D.B.	W.B.	D.B.	W.B.	D.B.	W.B.	D.B.	W.B.	D.B.	W.B.	D.B.	W.B.
Outside shed-	July	59.2	55.4	59.9	55.8	63.5	58.0	65.2	58.8	66.4	59.3	66.3	59.5	66.1	59.2
	August	55.2	52.2	56.3	53.0	59.0	54.2	60.9	55.4	61.1	55.8	61.1	56.0	60.7	55.7
Inside "dry" fan duct	July	59.0	55.3	62.7	57.8	66.1	59.6	70.7	61.9	71.7	62.3	72.7	62.8	74.9	63.5
	August	56.3	52.7	58.9	54.3	62.6	56.0	66.2	58.3	66.2	58.8	67.3	59.5	67.6	59.8
Inside "large" shed	July C.	67.4	—	71.4	—	75.8	—	79.0	—	80.8	—	82.9	—	83.2	—
	S.	66.1	—	70.0	—	73.6	—	76.3	—	77.2	—	79.2	—	79.2	—
	August C.	65.4	58.7	70.1	62.6	74.7	65.7	77.9	68.4	78.5	68.2	81.0	69.9	81.5	70.3
	S.	62.3	—	66.3	—	69.2	—	71.5	—	71.7	—	73.4	—	73.7	—
Inside "wet" fan duct	July	56.2	54.1	59.8	57.4	61.7	58.7	64.0	59.9	64.3	60.2	64.8	60.3	64.7	60.7
	August	54.3	53.3	56.1	54.6	58.7	56.3	60.1	57.4	61.0	58.1	60.9	58.2	61.1	58.1
Inside "small" shed	July C.	64.6	—	68.7	—	71.2	—	73.9	—	74.8	—	77.5	—	78.0	—
	August C.	62.5	56.6	65.8	60.0	68.2	62.2	70.5	63.8	71.2	64.3	72.6	65.3	72.9	65.6

APPENDIX XVIII.

REPORT on some observations carried out on the suggestion of questions raised by Prof. Lorrain Smith and Mr. D. R. Wilson, relating to temperature reduction in buildings by means of forced ventilation during hot weather.

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In the first place we must consider the position from which the air to be used is abstracted. The intake for any system of forced ventilation or humidification should be placed on that face of the building having a northerly aspect—that is between north-west and north-east. The reason being that on such side of a building in this country there will be very little direct sunshine. Therefore the ground and face of the building will not be heated beyond the temperature of the adjacent air. Were the intake to be placed at any other aspect the temperature of the air at the intake would be higher than that in such shade as would be offered from the north side. This heating being due to the radiation of the sunlight absorbed by the ground and buildings adjacent to the intake.

Again, if the intake is placed above the roof, as in some systems, the temperature would be still higher than the general shade temperature of the day, and possibly to a greater degree than with the installation on a southerly aspect. In such position the air overlying the roof is heated by the radiation from the roofing, and by percolation from the inside air, the inside air being probably much above the outside air with reference to temperature. To illustrate this point observations of temperature, dry and wet bulb, were taken on the roof of the dye-house given in the Table I, also the comparative temperatures in shade, and inside the ridges of roof. The shade temperatures are from thermometers mounted in a standard Stevenson screen on the adjacent public garden.

TABLE I.

Temperatures in shade.		Between the ridges on roof with all ventilators closed.		Inside the ridges of the roof.	
Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.
58·0	52·9	63·8	55·3	89·8	72·1
59·0	53·8	65·1	56·6	84·0	70·4

Showing a rise of temperature due to radiation and percolation of 6° F. There was a brisk south-easterly wind blowing and no sunshine on this day, or the difference would have been greater. These figures clearly demonstrate that the intake of air to be used for the reduction of temperature within a building should not be placed above the roof. In short, no intake should have a temperature which is higher than the temperature of the day. What degree of saturation can be reached using fine or heavy water sprays and varying speeds of fans. The observations in the accompanying tables, made in the intake chamber after the air has passed the sprays, provides data for comparison. In one respect we could not obtain a relatively slow fan movement with the installation, as below 590 revolutions per minute the motor is automatically cut off. So that we may have been moving the air too quickly for it to become completely saturated. On August 14 the outside air temperatures of 65·2° dry and 58·8° wet bulb, with 66 per cent., were changed to 63·5° dry bulb, 62·2° wet, with 92 per cent. of saturation after passing through the heavy spray, whilst with the spray cut off and before the whole was dry the temperatures were 64·0 and 59·9, giving humidity of 77 per cent., showing that the spraying increased the humidity 15 per cent., with a reduction of one and a-half degrees in the dry bulb reading. Generally the observations demonstrate that it is not possible to obtain absolute saturation with the spray and speed obtainable in this plant. Certainly there was the disadvantage of the temperature of the water being practically the same as the outside air, not as would generally be the case during exceptionally hot weather. On the 18th the water temperature was above the shade, and the temperature in intake chamber showed that the air had warmed by 2° F. Observations were taken of the temperature variation in the dyehouse at the Municipal School of Technology, Manchester, a building mainly of one storey with ridged roof, the cubic capacity of which is 195,800 cubic feet without machinery. The machines being for paper making, calico printing and dyeing, etc. The weights of metal being proportioned as follows:—

Machinery	-	-	-	86 tons
Pulleys	-	-	-	1 „ 5 cwt.
Shafting	-	-	-	5 „
Hangers and Pedestals	-	-	-	3 „
Columns	-	-	-	15 „
Girders	-	-	-	40 „

A total of - - - 150 tons 5 cwt.

In the north-west corner of this building is installed a Sturtevant plant for the heating and ventilation, comprising:—
(1) A series of sprays giving 40 or 160 gallons per hour. The air used after passing these sprays is carried down below the level of the general building and passes through a cooling cleaning chamber, formed by
(2) A series of sheets of corrugated iron, mounted vertically about 2 inches apart, then through a horizontal chamber, called in these notes the intake chamber, where the observations were made, to
(3) The heater and
(4) The fan, whence it is forced along a number of ducts under the floor of the building. Inlets to the room have been made at the base of every other pillar on which the roofing girders are carried, 16 in all. In some of the experiments all these were closed, and the manholes (five in number) of the ducts were opened. Observations were made of the temperatures, dry and wet bulbs, in the following positions in the shade (see Tables II.-V.):—
Intake, in the chamber between the spray cooling arrangement and the fan.
Duct, in the duct just previous to entry into the building.
Room, at a height of 4 ft. 6 ins. above the floor, free from any mass of metal or walls in the centre of room.
Outlet, at one of the openings where the air was leaving the building.
Iron A } Indicate the temperatures of masses of ma-
Iron B } chinery in two positions in the building.
Speed of air movement in intake chamber represent the anemometer indication in feet per minute of the air motion through the intake chamber, the cross section of which represents 70 square feet. The temperature of the water was the temperature of the general town supply for the day. All the observations have been corrected for known errors of scale, etc. These were verified during the course of the experiments by comparison with standards. The observations indicate that it is not possible rapidly to reduce the temperatures of the air in large rooms containing masses of machinery which, together with the walls, have taken up the temperature of the air. As in practice, to reduce the air temperature, we have only the amount of difference of temperature between the air and water to be effective, and the masses of metal, etc., will only yield its heat at a rate of about 1° F. per hour. This heat, radiated into the air of the room, tends to increase the relative dryness of the air in room, as its effect is upon the dry bulb only. So that although the air may be inserted at saturation on

mixture with the air in room, the amount of moisture per cubic foot of air may not be altered, the relative humidity is decreased owing to the greater capacity of the warm air for moisture.

During exceptionally hot weather, to reduce and keep the temperature in mills or large works to that suitable for working conditions, the ventilation plant should be run all night, as during those hours the tem-

perature of the outside air is lowest, and the result produced would be most effective.

The question as to at what temperature does a rapid air movement (draught) cease to be uncomfortable or injurious is not easy of assignment, owing to the varying personal temperaments.

WILLIAM C. JENKINS.

October 28th, 1908.

TABLE II.

1908, August 14th.

Position.	TIME.																	
	3.30 p.m.			4.35 p.m.			4.48 p.m.			4.53 p.m.			5.6 p.m.			5.20 p.m.		
	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.
Shade	65.2	58.8	66	—	—	—	—	—	—	—	—	—	—	—	—	60.5	56.1	74
Intake	—	—	—	63.5	62.2	92	—	—	—	—	—	—	—	—	—	—	—	—
Duct	—	—	—	64	59.9	77	—	—	—	—	—	—	62	59.1	83	—	—	—
Room	—	—	—	82.2	70.5	—	83.6	71.8	—	82.2	69.6	—	77.7	67.7	—	—	—	—
Outlet	—	—	—	—	—	—	74.1	63.4	—	77.2	66.5	—	70.3	61.8	—	—	—	—
Iron A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron B	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Air movement in intake chamber - - - - 546 feet per minute.

Temperature of water used for spraying - - - 61° Fahr.

The room had been warmed by means of hot air and the circulation of steam in pipes, from 2.15 p.m. to 4.30 p.m., the temperature of air being 121° Fahr., but this only raised the wall temperature to 79° Fahr.

TABLE III.

1908, August 17th.

Position.	TIME.																	
	12.0 noon.			12.12 p.m.			12.50 p.m.			1.45 p.m.			2.45 p.m.			3.45 p.m.		
	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.
Shade	67.0	57.8	55	—	—	—	—	—	—	—	—	—	68.0	58.6	54	—	—	—
Intake	68.2	63.6	75	—	—	—	62.8	60.9	89	63.0	60.4	84	63.0	60.9	87	65.1	60.9	77
Duct	—	—	—	76.9	63.4	46	69.2	60.5	57	65.7	59.3	67	65.7	59.3	67	66.5	60.3	67
Room	80.7	67.5	47	—	—	—	76.9	66.1	54	75.7	65.8	55	75.2	66.3	59	75.1	65.8	57
Outlet	73.7	63.5	—	—	—	—	71.7	62.8	—	70.9	63.0	—	70.9	63.0	—	70.5	63.0	—
Iron A	—	—	—	—	—	—	78.7	—	—	77.9	—	—	77.4	—	—	—	—	—
Iron B	—	—	—	—	—	—	75.5	—	—	75.0	—	—	75.0	—	—	—	—	—

Air movement in intake chamber - - - - 632 feet per minute.

Temperature of water used for spraying - - - 62° Fahr.

The temperature of the building had been maintained during the previous evening by means of radiation from the steam pipes. During this day all inlets were closed, and 5 of the manholes to ducts were opened.

TABLE IV.

1908, August 18th.

Position.	TIME.																	
	9.0 a.m.			10.45 a.m.			11.25 a.m.			11.45 a.m.			12.0 noon.			2.15 p.m.		
	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.
Shade	55.3	51.6	—	—	—	—	57.1	53.0	—	—	—	—	57.2	53.0	—	—	—	—
Intake	—	—	—	60.0	57.7	—	61.0	57.9	—	60.0	57.7	—	60.0	57.7	—	60.3	58.4	—
Duct	—	—	—	—	—	—	67.2	60.5	—	64.4	58.3	—	63.7	58.3	—	64.7	58.9	—
Room	—	—	—	73.6	63.8	—	69.7	62.3	—	71.9	62.9	—	70.9	63.2	—	70.7	62.3	—
Outlet	—	—	—	67.9	60.5	—	70.7	61.0	—	64.9	58.6	—	67.9	60.9	—	62.7	58.3	—
Iron A	—	—	—	78.9	—	—	77.9	—	—	76.9	—	—	76.7	—	—	73.7	—	—
Iron B	—	—	—	78.0	—	—	75.6	—	—	75.0	—	—	74.8	—	—	72.4	—	—

Air movement in intake chamber at 11.25, 489 ft. per minute; at 11.45, 532 ft. per minute; at 12.0, 311 ft. per minute.

Temperature of water - - - - 61° Fahr.

At 11.30—reduced speed of fan from 700 to 650 revolutions per minute.

At 11.45—during this speed test the large doors had been opened; these were re-closed for the noon determination

TABLE V.

1908, August 20th.

Position.	TIME.											
	12.15 p.m.			12.25 p.m.			12.35 p.m.			2.0 p.m.		
	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.	D.B.	W.B.	Rel. Hum.
Shade	59.0	53.8	70	—	—	—	—	—	—	60.0	54.5	69
Intake	—	—	—	—	—	—	59.5	57.7	89	59.0	57.9	93
Duct	—	—	—	—	—	—	70.0	59.8	—	66.7	58.3	—
Room	81.9	69.3	—	82.0	69.1	—	81.1	69.1	—	78.3	66.3	—
Outlet	—	—	—	—	—	—	77.9	63.3	—	74.5	61.5	—
Iron A	84.7	—	—	—	—	—	82.9	—	—	80.4	—	—
Iron B	81.8	—	—	—	—	—	81.4	—	—	78.5	—	—

Temperature of water—61° Fahr.

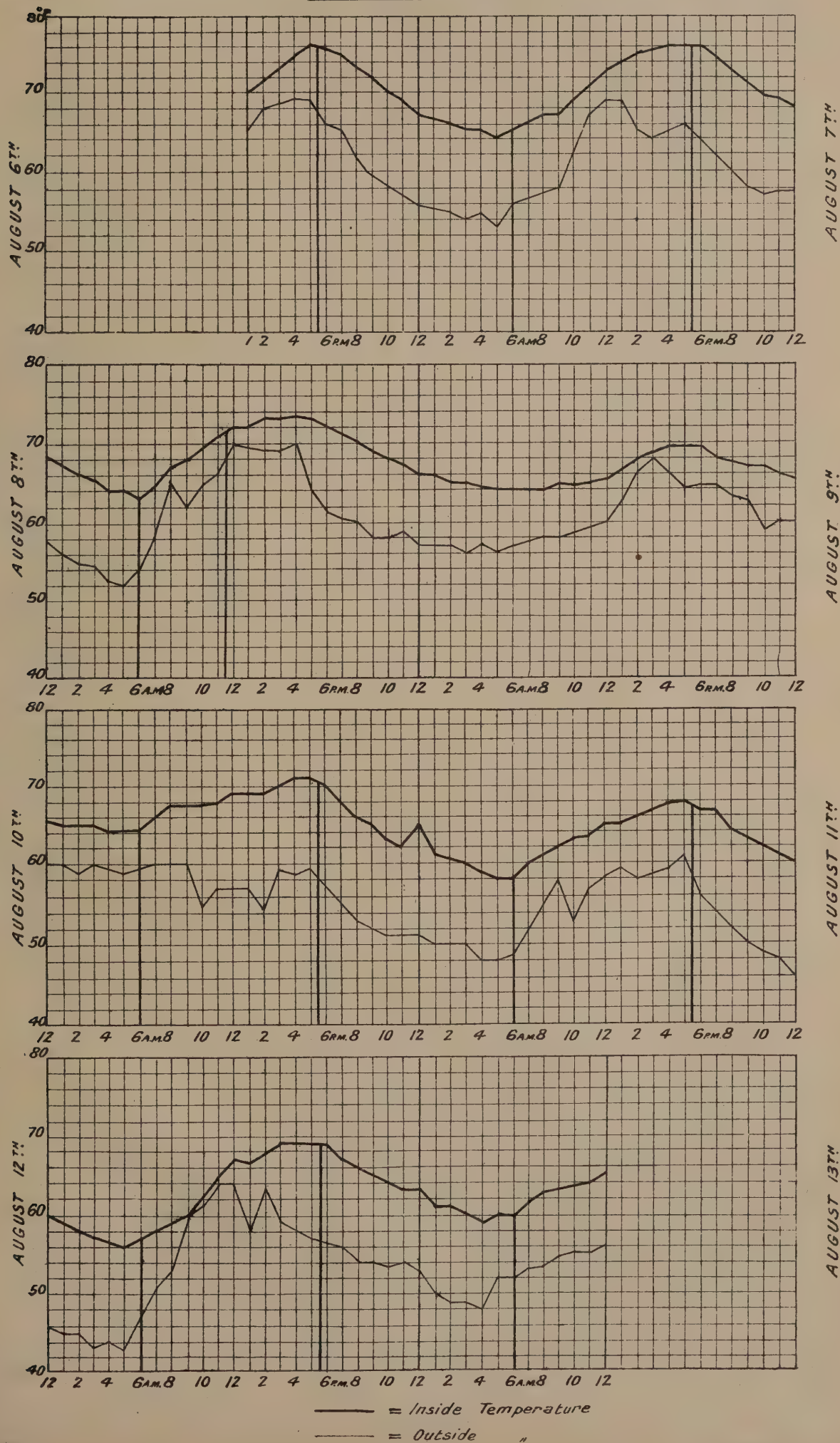
Fine spray used.

APPENDIX XIX.

DIURNAL VARIATIONS OF INSIDE AND OUTSIDE DRY BULB TEMPERATURES FOR FOUR SHEDS DURING ONE WEEK, 6TH TO 13TH AUGUST, 1908.

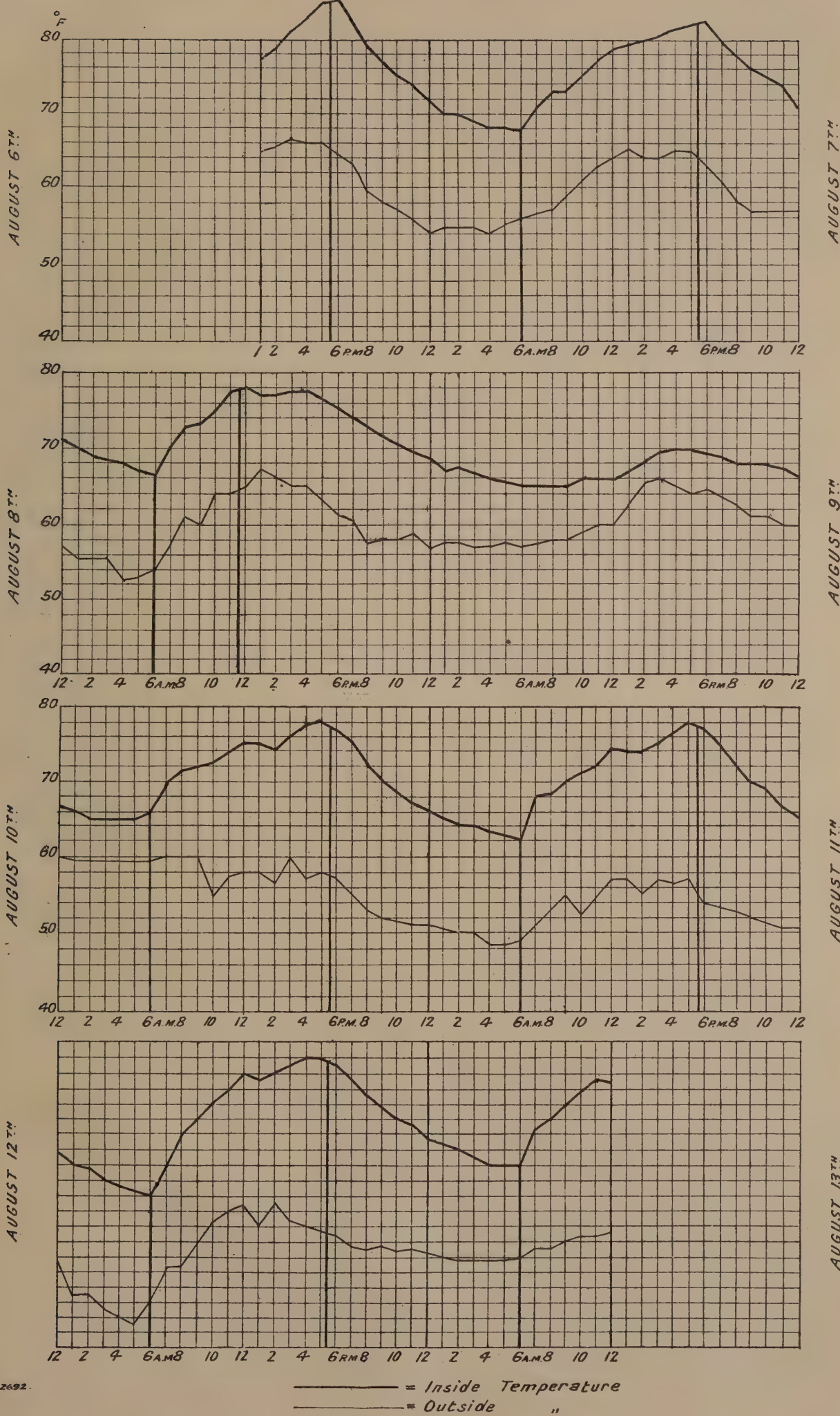
SHED N^o 1.

NON-HUMIDIFIED.



SHED N^o 2.

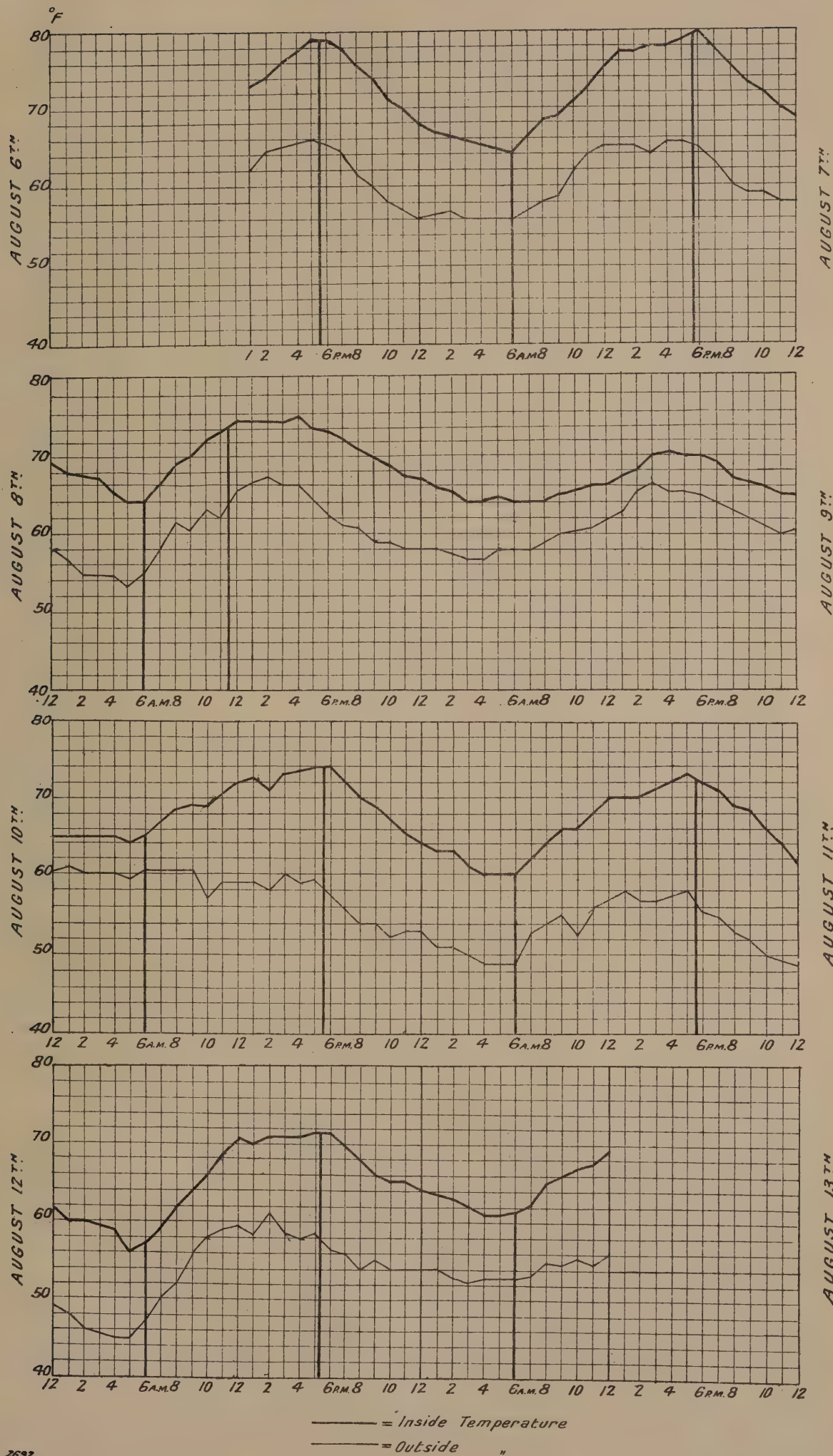
HUMIDIFIER:- HART'S AND STEAM-JETS.



— = Inside Temperature
- - = Outside " "

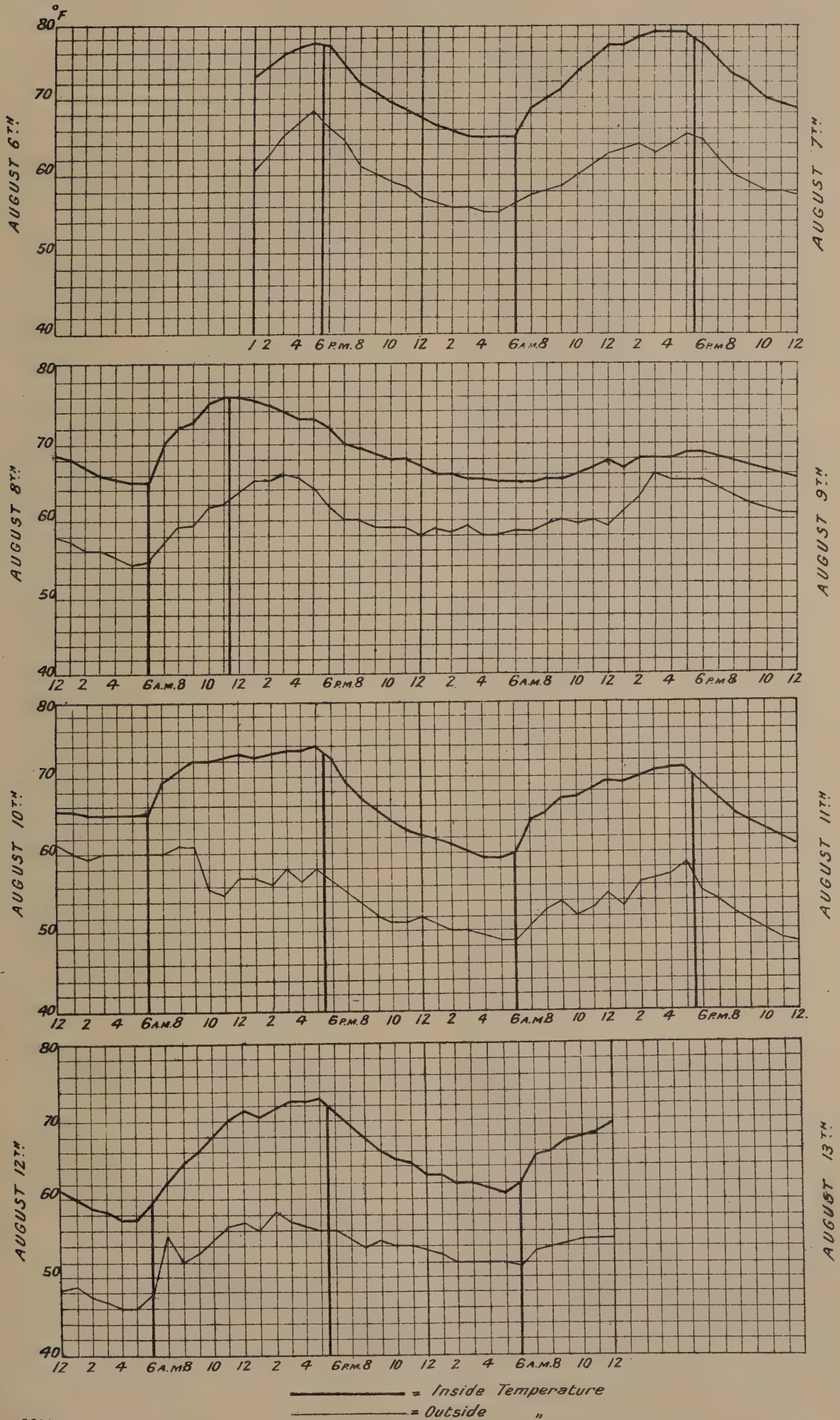
SHED N^o 3.

HUMIDIFIER:- MATHER AND PLATT.(VORTEX.)



SHED N^o 4.

HUMIDIFIER-STEAM JETS.



APPENDIX XX.

LIST OF WORKS VISITED BY THE COMMITTEE.

No.	Date.	Name of firm.	Address.	Humid or dry.	Process.
1	7th January	J. Coupe & Sons - - - -	Rosehill Mill, Heywood -	D.	Cotton weaving.
2	" "	Highfield Spinning and Manufacturing Co., Ltd.	Highfield Mill, Heywood	H.	" "
3	" "	Co-operative Wholesale Society, Ltd.	Springs, Bury - -	H.	" "
4	8th "	Pickup & Holden - - - -	Bank Top Mill, Darwen -	H.&D.	" "
5	" "	Baynes, Taylor & Co. - - -	New Mill, Darwen - -	H.	" "
6	" "	Cobden Street Manufacturing Co., Ltd.	Cobden Mill, Blackburn -	H.	" "
7	" "	E. & G. Hindle, Ltd. - - -	Royal Mill, Blackburn -	H.	" "
8	" "	Duckworth & Eddlestone - -	Roe Lee Mill, Blackburn	H.	" "
9	9th "	Talbot Spinning and Weaving Co., Ltd.	Bagganley Lane, Chorley	H.	" "
10	" "	German Street Mill Co., Ltd.	Derby Street Mill, Bolton	H.	" "
11	" "	Horrockses, Crewdson and Co. -	Moses Gate, Bolton -	H.	" "
12	10th January	Eccles Spinning & Weaving Co. -	Patricroft, Manchester -	H.	" "
13	" "	Napier Mills Co., Ltd. - - -	Napier Mills, Oldham -	H.	Cotton spinning.
14	" "	Ashton Bros. & Co. - - -	Throstlebank Mill, Hyde	H.	Cotton weaving.
15	" "	" "	Carrfield Mill, Hyde -	D.	" "
16	26th February	Albert Mill Co. - - - -	Columbia Mill, Blackburn	H.	" "
17	" "	Cardwell Mill Co. - - - -	Cardwell Mill, Blackburn	H.&D.	" "
18	" "	Geo. Green & Co. - - - -	Jubilee Mill, Padiham -	H.	" "
19	28th "	Rawson Bros. - - - -	Albion Mill, Church -	H.	" "
20	" "	Whipp Bros. - - - -	Primrose Mill, Church -	H.	" "
21	" "	Woodnook Manufacturing Co. -	Victoria Mill, Accrington	H.	" "
22	4th March	G. & J. Shepherd - - - -	Holmes Mill, Bacup -	H.	" "
23	" "	J. Maden & Son - - - -	Spring Holm Mill, Bacup	H.	" "
24	" "	J. H. Ashworth & Co. - - -	Hall Carr Mill, Rawtenstall	H.	" "
25	" "	D. Whitehead & Co. - - -	Lower Mill, Rawtenstall	H.	" "
26	5th "	Fielden Bros. - - - -	Waterside Mill, Todmorden	H.	" "
27	" "	Luke Barker & Co. - - - -	Crow Carr Ings Mill, Todmorden	H.	" "
28	" "	Caleb Hoyle, Ltd. - - - -	Derdale Mill, Todmorden	H.	" "
29	" "	S. & J. Sutcliffe - - - -	Sandholme Mill, Todmorden	H.	" "
30	6th "	Horrockses, Crewdson & Co. -	Dale Street Mill, Preston	H.	" "
31	" "	" "	Yard Works, Preston -	H.	" "
32	" "	Eccles Bros., Ltd. - - - -	Dale Street Mill, Preston	H.	" "
33	" "	Oxhey Spinning and Manufacturing Co.	Brook Street, Preston -	H.	" "
34	" "	J. & A. Leigh, Ltd. - - - -	Brookhouse Mill, Preston	H.	" "
35	25th "	R. Shaw & Sons - - - -	Stanley Mills, Colne -	H.	" "
36	" "	Thos. Foulds & Sons - - -	Green Shed, Colne -	D.	" "
37	" "	Hartley & Co. - - - -	Albert Mills, Nelson -	D.	" "
38	" "	Hartley & Wilkinson - - -	Pendle Street Shed, Nelson	D.	" "
39	" "	Read & Dyson - - - -	Springbank Mill, Nelson	D.	" "
40	26th "	B. Thornber & Son - - - -	Daneshouse Mill, Burnley	D.	" "
41	" "	J. Dugdale, Sons and Bro. -	Lower House Mill, Burnley	H.	" "
42	" "	W. Burrows & Son - - - -	Whittlefield Shed, Burnley	D.	" "
43	27th "	Kershaw, Leese & Co. - - -	India Mill, Stockport -	H.	" "
44	" "	R. McClure & Son - - - -	Travis Brook Mill, Stockport	H.	" "
45	8th April	R. A. Whytlaw & Sons - - -	Well Road, Glasgow -	D.	" "
46	" "	D. Govan & Sons - - - -	Well Road, Glasgow -	D.	" "
47	" "	Geo. Grant & Sons - - - -	David Street, Glasgow -	D.	" "
48	" "	A. P. Bird & Co. - - - -	John Street, Glasgow -	D.	" "
49	" "	Muir & Smith - - - -	John Street, Glasgow -	D.	" "
50	" "	W. Strang & Co. - - - -	Greenhead Street, Glasgow	D.	" "
51	" "	Forrest, Frew & Co. - - -	Main Street, Glasgow -	D.	" "
52	" "	J. Brown & Son - - - -	Adelphi Street, Glasgow	D.	" "
53	" "	" "	Carstairs Street, Glasgow	D.	" "
54	22nd "	W. and J. Slingsby, Ltd. -	Carleton, Skipton -	H.	" "
55	" "	S. Farey & Son - - - -	Firth Mill, Skipton -	D.	" "
56	" "	D. Dickson & Co. - - - -	Broughton Road, Skipton	D.	" "
57	" "	J. Nutter & Sons - - - -	Bankfield Mill, Barnoldswick	D.	" "
58	" "	J. Windle & Sons - - - -	Wellhouse Mill, Barnoldswick	D.	" "

No.	Date.	Name of firm.	Address.	Humid or dry.	Process.
59	23rd April	D. Illingworth & Sons	Whetley Mills, Bradford	D.	Worsted spinning.
60	" "	J. Smith & Son	Fieldhead Mills, Bradford	H.	" "
61	" "	J. Foster & Son, Ltd.	Black Dike Mill, Queensbury	H.&D.	Worsted spinning and weaving.
62	" "	W. & J. Whitehead	New Lane Mill, Laisterdyke	—	" "
63	21st July	J. Wood & Bros., Ltd.	Howardtown Mills, Glossop	H.	Cotton weaving.
64	22nd "	W. H. Hornby & Co., Ltd.	Brookhouse Mill, Blackburn	H.	" "
65	" "	J. Dugdale & Sons, Ltd.	Higher Audley Street, Blackburn	H.	" "
66	" "	J. Thompson & Co.	Audley Mill, Blackburn	H.	" "
67	" "	Higson Bros., Ltd.	Canton Mill, Blackburn	H.	" "
68	23rd "	S. Turner & Co., Ltd.	Spotland Bridge, Rochdale	D.	" "
69	" "	Sladenwood Mill Co.	Summit Mills, Littleborough	H.	" "
70	6th August	S. Longworth & Son	Judge Walmsley Mill, Whalley, Clitheroe	H.	" "
71	" "	Rusden & Co.	Shawbridge Street, Clitheroe	D.	" "
72	" "	T. Garnett & Sons	Low Moor, Clitheroe	H.	" "
73	7th "	E. Halstead, Ltd.	Queensgate Mill, Burnley	D.	" "
74	" "	J. H. Grey, Ltd.	Livingstone Mill, Burnley	D.	" "
75	" "	J. Halliwell, Ltd.	George Street Mill, Burnley	H.	" "
76	" "	Darwen Manufacturing Co.	Carr Mill, Darwen	H.	" "

APPENDIX XXI.

BURNLEY AND DISTRICT WEAVERS, WINDERS AND BEAMERS ASSOCIATION.

At a Special Meeting of Members of the above Association, convened by requisition, held on March 28th, 1906, it was unanimously resolved—

“That this meeting is of the opinion that the time is opportune for the total abolition of steaming in weaving sheds, and instructs the Committee to take such steps as are necessary to bring about that object.”

As a preliminary towards carrying into effect the above resolution the Committee decided to ascertain the opinion of those at present employed under the Steaming Act, and for this purpose every operative who entered the mill during the meal hour was supplied with a paper (a copy of which is attached), and these papers were collected at the stopping time. Previous to the distribution of these papers, a meeting of the weavers was held at each mill and the operatives were asked to assist the Committee by filling in the particulars required, and especially to use their own judgment when giving their vote for or against steaming.

Even by this method we fail to get the opinion of a vast number of people who have at one time or other worked under steaming, but are not so employed at present.

We have also taken the liberty of ascertaining the opinion of the operatives employed at three sheds, who, although not at the present moment working under the Act, have the apparatus still in the shed.

A word of explanation may be needed with regard to the figures under the heading “Other Persons.” As stated previously, every person entering the mill was supplied with a paper and the numbers placed in the column refer to the number of votes given by persons not describing themselves as weavers with looms, such as tenters, overlookers, winders, beamers, and in many cases no distinguishing mark at all.

All the papers are kept at the office, so that in the event of the figures being challenged, they may be produced.

By Order, THE COMMITTEE,
FRED THOMAS, *Secretary.*

COPY OF BALLOT PAPER.]

BURNLEY WEAVERS' ASSOCIATION.

BALLOT PAPER.

YES. NO.

Are you in favour of Steaming in Weaving Sheds? - - -		
---	--	--

Mark the space with a × the way you intend to vote.

First Number of Looms.....

Last Number of Looms.....

How long employed under steaming.....

By Order,
THE COMMITTEE.

RESULT OF BALLOT.

Name of firm.	Number of looms.	Votes in favour of steaming.	Votes against steaming.	Total votes.	Looms represented in favour of steaming.	Looms represented against steaming.	Other persons.		Length of time employed under steaming.*					
							In favour.	Against.	Up to one year.	Over one year to two years.	Over two years to five years.	Over five years to ten years.	Over ten years.	Not stated.
Messrs. Robert Emmott, Stanley Mill - - -	1,836	0	501	501	0	1,671	0	89	50	53	313	18	9	58
Messrs. James Lee & Bro., Elm St. Shed - - -	943	0	261	261	0	851	0	41	25	30	91	58	3	54
Messrs. John Grey, Ltd., Elm St. Shed - - -	400	0	112	112	0	372	0	19	10	4	40	44	4	10
Mr. John Windle, Elm St. Shed - - -	513	0	155	155	0	501	0	23	33	14	42	58	0	8
Messrs. John Spencer, Ltd., Queen's Mill - - -	858	2	282	284	6	852	1	67	27	33	81	100	2	41
Messrs. John Grey, Ltd., Livingstone Mill - -	1,396	1	385	386	4	1,247	0	67	31	31	91	119	93	21
Messrs. James Walton, Ltd., New Hall Mill - - -	432	0	126	126	0	425	0	24	12	14	82	8	0	10
Messrs. Richard Stuttard, Ltd., Byerden Shed - -	1,010	3	294	297	10	934	0	59	28	18	60	151	5	35
Messrs. Richard Stuttard, Ltd., Primrose Mill - -	891	1	257	258	4	870	0	25	27	143	36	29	11	12
Messrs. Ed. Halstead, Ltd., Primrose Mill - - -	437	0	116	116	0	403	0	12	12	63	21	15	0	5
Messrs. W. Slater & Sons, Ltd., Ashfield Shed - -	841	0	266	266	0	819	0	58	26	22	155	17	6	40
Messrs. Witham Bros., Ltd., Plumbe St. Shed - - -	1,506	1	316	317	4	1,149	0	42	86	73	72	32	13	41
Messrs. Thorneybank Mill Co. - - -	953	0	250	250	0	882	0	10	43	36	57	51	39	24
Messrs. George St. Manuifg. Co., Ltd, Waterloo Shed	417	1	108	109	4	400	0	11	23	23	43	13	3	4
Messrs. Nuttall & Crook, Pendle View Shed - - -	636	0	151	151	0	568	0	6	36	87	6	1	2	19
Messrs. Temple & Sutcliffe, Ltd., Rosegrove Mill - -	550	1	151	152	2	504	0	5	15	14	97	5	2	19
Messrs. John Spencer, Ltd., Imperial Mill - - -	810	1	206	207	4	701	0	30	106	7	18	19	16	41
Messrs. J. Dugdale & Bros., Lowerhouse Mill - - -	1,531	0	422	422	0	1,407	0	22	22	40	71	101	154	34
	15,960	11	4,359	4,370	38	14,556	1	610	612	705	1,376	839	362	476

* Not necessarily employed for that length of time with one particular firm.

THE NORTHERN COUNTIES AMALGAMATED ASSOCIATIONS OF WEAVERS.

RESULT OF THE BALLOT

Taken on the Question of Steaming in Weaving Sheds.

	For.	Against.	Neutrals.
Blackburn - - - -	383	10,526	117
Burnley - - - -	12	4,359	—
Ashton - - - -	317	3,029	55
Preston - - - -	146	4,003	—
Accrington - - - -	78	1,404	—
Chorley - - - -	139	2,783	99
Padiham - - - -	63	2,938	39
Haslingden - - - -	45	2,058	25
Rishton - - - -	49	1,528	55
Nelson - - - -	1	256	—
Ramsbottom - - - -	45	1,287	28
Clitheroe - - - -	23	1,567	19
Oldham - - - -	38	613	—
Bury - - - -	167	916	—
Todmorden - - - -	40	2,394	92
Sabden - - - -	8	142	7
Londridge - - - -		No return	—
Bamber Bridge - - - -	30	1,356	—
Heywood - - - -	44	1,682	60
Hyde and Hadfield - - - -	393	2,134	138
Colne - - - -	2	724	—
Ressendale - - - -	105	1,451	69
Glossop - - - -	36	1,135	27
Bacup - - - -	124	1,889	—
Whitworth - - - -	30	871	—
Bolton - - - -		No return	—
Macclesfield - - - -	25	435	14
Church - - - -	154	2,787	—
Darwen - - - -	448	6,569	270
Saddleworth - - - -		No return	—
Harwood - - - -	52	3,663	78
Clayton - - - -	17	1,223	16
Blackburn - - - -	71	2,488	13
Congleton - - - -		No return	—
Barnoldswick - - - -		No return	—
Rochdale - - - -		No return	—
	3,094	68,154	1,221
TOTAL VOTE - - -		72,469	

Ewbank Chambers, Accrington,
November 28th, 1906.

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